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THE
Malayan Agricultural Journal
OCTOBER, 1953.

EDITORIAL

Rice Variety Trials in Malaya. Several recent issues of the Journal have contained articles setting down the results of agronomic investigations into the improvement in yield of rice in Malaya; we now have two articles by Mr. Brown, Botanist, Department of Agriculture, the first dealing with the varietal extension trials carried out in the 1952-53 padi season, and the second concerning hybrid vigour in rice.

The varietal extension trials were pilot trials laid down to gain experience for the time when the main trials of the first post-war selections of padi are carried out. However, in addition to the experience gained, valuable information was obtained concerning the ecological areas to which the new selections will be most suited.

In his second article, Mr. Brown describes and gives the results of an experiment in which 28 crosses of local varieties of rice were sown in the 1951-52 season and their progeny sown in the following season.

Pineapples in Malaya. In his third article, Mr. Brown gives a brief history of the pineapple plant with special reference to Malaya, and describes the several Malayan varieties and methods of improving those varieties.

Malayan canned pineapple was known in most parts of the world before the war but the occupation of Malaya crippled the industry. However, great strides have been made in the rehabilitation of holdings and canneries and the production in 1953 is expected to be in the region of 800,000 cases.

VARIETAL EXTENSION TRIALS WITH WET PADI, 1952-53

BY

F. B. BROWN,

Botanist.

Introduction.

Before a new variety or strain of padi can be confidently recommended to the planter, it is essential for it to be tested under the same conditions under which it will eventually be grown. This is normally carried out by means of extension trials in which as many small plots as possible of the variety under test are laid down at random over the selected area. Such trials involve a considerable amount of administrative detail in order to function smoothly, and it was with the purpose of resolving administrative difficulties as well as providing experience for personnel that the 1952-53 series of trials were laid down. When the first post-war selections become available a smooth working plan should therefore be ready for implementation.

Varietal extension trials were laid down in:—

- (i) the South Krian District of Perak, to compare unselected Seri Raja with local varieties, and
- (ii) Malacca, with Reyong 6 in the coastal districts and Serendah Kuning in the inland districts, for similar comparisons to be made.

Trials in South Krian, Perak.

Completed variety trials (the 1947-50 series) suggested that Seri Raja, a medium to long term padi, could be expected to do well over a large area of Perak. Pure line selection of this variety was started in the 1951-52 season, and it was considered that the information gained from an extension trial would define the areas in which future Seri Raja selections should be tested. Staff shortages limited the area in which the trial could be carried out to the districts of Bagan Serai, Biah, Semanggol and Selinsing in South Krian. This area represents some 30,000 acres of padi, and 60 plots (one per 500 acres) were chosen at random, as far as possible, over the area.

Distribution was as follows:—

Biah	....	4 plots.	Semanggol	....	16 plots.
Selinsing	....	8 plots.	Bagan Serai	....	32 plots.

Planters were supplied with sufficient seed of Seri Raja to plant about $\frac{1}{4}$ acre. Where *petak-petak** were large, half was planted with Seri Raja and half with the locally grown variety; where they were small, two or more adjacent ones were used. Plots were regularly visited during the growing season and records of growth, flowering, pest and disease incidence etc. compiled.

* petak-petak = The small, square divisions of a padi area.

At harvest, a point was selected at random in each half of the field and two 1/40 acre plots, one of the local variety and one of Seri Raja, were marked off, and the yield measured in gantangs (gallons) to the nearest 1/16 gantang. It should be noted that in those plots where Seri Raja occurs as the local variety, analyses have been duplicated to provide the comparisons—

(a) Local Varieties (including Seri Raja)—Seri Raja.

(b) Local Varieties (excluding Seri Raja)—Seri Raja.

A summary of results is given below:—

BAGAN SERAI DISTRICT.

Table I.
Yields of Padi in the Bagan Serai District.
(Gantangs per Acre)

Plot No.	Local Variety.	Yield.		Difference.
		Local.	Seri Raja.	
1	Machang	125	150	+ 25
2	Haji Ahmad	110	90	— 20
3	Mayang Sa Batil	205	240	+ 35
4	Pahit Puteh	260	270	+ 10
5	Mayang Sa Batil	220	233	+ 13
6	Seri Panji	165	180	+ 15
7	Machang	180	202.5	+ 22.5
8	Biji Limau	213	220	+ 7
9	Bayar	140	165	+ 25
10	Machang	85	110	+ 25
11	Seraup	162.5	273	+ 110.5
12	Radin Che Mah	125	140	+ 15
13	Radin Kuning	260	282.5	+ 22.5
14	Seraup	193	230	+ 37
15	Biji Limau	262.5	290	+ 27.5
16	" "	265	272.5	+ 7.5
17	Seraup	180	192.5	+ 12.5
18	Pahit Puteh	292.5	300	+ 7.5
19	Machang	220	205	— 15
20	Biji Limau	165	190	+ 25
21	Machang	140	142.5	+ 2.5
22	" "	145	180	+ 35
23	" "	140	122.5	— 17.5
24	Gumpal	162.5	330	+ 167.5
25	Seri Raja	85	90	+ 5
26	" "	162.5	167.5	+ 5
27	Bayar	175	202.5	+ 27.5
28	Seri Raja	255	260	+ 5
29	Biji Limau	160	195	+ 35
30	Machang	200	250	+ 50
31	Padi Kuning	172.5	220	+ 47.5
32	" "	167.5	220	+ 52.5
Total	....	5,793.5	6,616.0	+ 822.5
Mean Yield	....	181.05	206.75	....

Mean Difference = 25.70 gantangs per acre.

s = 35.36. S.E. mean diff. = 6.25. t = 4.11. Sig. at 1% point.

It appears that although long terms varieties predominate in this locality, the slightly shorter termed Seri Raja variety could be expected to give increased yields. The average increase in yield of Seri Raja over the local variety is of the order of 14.2 per cent. during this season.

SEMANGGOL DISTRICT.

Table II.
Yields of Padi in the Semanggol District.
(Gantangs per Acre).

Plot No.	Local Variety.	Yield.		Difference.
		Local.	Seri Raja.	
37	Seraup	240	220	- 20
38	Radin Che Mah	180	320	+ 140
39	Gempa Pulau	200	240	+ 40
40	Rambut	280	260	- 20
41	Radin Kuning	280	320	+ 40
42	Nachin 11	180	280	+ 100
43	Siam 29	320	300	- 20
44	Seri Raja	160	160	—
45	" "	160	150	- 10
46	" "	260	280	+ 20
47	Mayang Ebos	300	400	+ 100
48	Seri Raja	260	220	- 40
49	" "	280	240	- 40
50	" "	320	280	- 40
51	" "	240	200	- 40
52	Radin Kuning	200	240	+ 40
Total	....	3,860	4,110	+ 250
Mean Yield	....	241.25	256.875	....

Mean Difference = 15.625 gantangs per acre.

s = 56.91. S.E. Mean Diff. = 14.23. t = 1.10. Not significant.

Table III.
Yields of Padi in the Semanggol District, Excluding Seri Raja/Seri Raja
Comparisons.
(Gantangs per Acre).

Plot.	Yield.		Difference.
	Local.	Seri Raja.	
37	240	220	- 20
38	180	320	+ 140
39	200	240	+ 40
40	280	260	- 20
41	280	320	+ 40
42	180	280	+ 100
43	320	300	- 20
47	300	400	+ 100
52	200	240	+ 40
Total	2,180	2,580	+ 400
Mean Yield	242.22	286.67	....

Mean Difference = 44.44 gantangs per acre. s = 99.19.

S.E. Mean Diff. = 33.06. t = 2.31. Not significant at 5% level.

Although Seri Raja has not significantly outyielded the local varieties, the increased yield obtained amounts to an average of 6.5 per cent.

In seven plots Seri Raja was tested against local Seri Raja which can be regarded as partially selected material due to the local planters' method of selecting the best ears at harvest for seed for the next crop.

If such plots are eliminated from the analysis the results are as shown in Table III.

Seri Raja has still not significantly outyielded the remaining local varieties due to the high error variance, but there is an indication that it is the superior variety. The increase in yield represents some 18.3 per cent. for this season.

BRIAH DISTRICT.

Table IV.
Yields of Padi in the Briah District.
(Gantangs per Acre)

Plot No.	Local Variety.	Yield.		Difference.
		Local.	Seri Raja.	
33	Radin Kulop	93	110	+ 17
34	Machang	80	100	+ 20
35	Seraup	270	293	+ 23
36	Machang	235	260	+ 25
Total	....	678	763	+ 85
Mean Yield	....	169.5	190.75	....

Mean Difference = 21.25 gantangs per acre.

$s = 3.5$. S.E. mean diff. = 1.75. $t = 12.14$. Sig. at 1% point.

Seri Raja has significantly outyielded the local varieties, the average increase being 12.5 per cent. It should be noted that the water supply for this district was delayed at the start of the season with the result that the long term varieties were at some disadvantage and conditions favoured the Seri Raja.

SELINSING DISTRICT.

Table V.
Yields of Padi in the Selinsing District. (Gantangs per Acre).

Plot No.	Local Variety.	Yield.		Difference.
		Local.	Seri Raja.	
53	Seri Raja	280	260	- 20
54	" "	280	300	+ 20
55	" "	330	310	- 20
56	" "	330	310	- 20
57	" "	190	160	- 30
58	" "	180	160	- 20
59	" "	190	180	- 10
60	" "	160	150	- 10
Total	....	1,940	1,830	- 110
Mean Yield	....	242.5	228.75	....

Mean difference = - 13.75 gantangs per acre. $s = 15.06$.

S.E. Mean Diff. = 5.32. $t = 2.58$. Significant at 5% point.

This part of the trial may be regarded as showing the measure of superiority of the planters' partially selected material against unselected Seri Raja. This significantly outyields (at the 5 per cent. point) the latter, the average increase being 5.7 per cent.

SUMMARY OF THE RESULTS IN SOUTH KRIAN.

Table VI.
Analysis of the Results from the 60 Plots.

	Total Yield. (Gantangs per Acre)		Difference.
	Local Varieties.	Seri Raja.	
	12,271.5	13,319.0	+ 1,047.5
Mean Yield	204.5	222.0	

Mean Difference = 17.5 gantangs per acre.

s = 40.98. S.E. Mean Diff. = 5.29. t = 3.30. Significant at 1% point.

Thus in the 1952-53 season in the South Krian Districts as a whole Seri Raja has significantly outyielded local varieties by an average of 17.46 gantangs per acre or 8.55 per cent.

One other comparison which can be made is in the relative increase in yield on second and third class land. Plots Nos. 3, 4, 5, 8, 17, 18, 19, 47, 48 and 49 were sited on second-class, the remainder on third-class padi land.

Table VII.
Yields of Padi on 2nd and 3rd Class Land in South Krian.
(Gantangs per Acre).
2nd Class Land.

	Yields.		Difference.
	Local.	Seri Raja.	
Total	2,430.5	2,520.5	+ 90
Mean Yield	243.05	252.05	—

Mean Difference = 9 gantangs per acre.

s = 39.96. S.E. Mean Diff. 13.32. t = 0.71. Not Significant.

3rd Class Land.

	Yields.		Difference.
	Local.	Seri Raja.	
Total	9,841.0	10,798.5	+ 957.5
Mean Yield	196.82	215.97	—

Mean Difference = 19.15 gantangs per acre.

s = 41.36. S.E. Mean Diff. = 5.85. t = 3.27. Significant at 1% point.

From these figures the third-class land appears to be more suitable for Seri Raja than the second-class. This is quite understandable, as the classification of land depends partly on the date of supply of irrigation water—the lower the class the later the supply, i.e. the shorter the maturation period must be.

The South Krian trial can be counted as a successful trial and clearly shows the need for standardisation of varieties to suit local conditions.

This trial is being extended in the 1953-54 season to the remaining padi growing districts of South Perak.

Malacca.

The varietal extension trial in Malacca was laid down in much the same way as the trial in South Krian but the following two varieties were tested:—

- (i) Reyong 6—a Kedah medium term variety—in the coastal districts of Central East and Central West Malacca, and
- (ii) Serendah Kuning in the inland districts of Jasin and Alor Gajah.

A total of 85 plots was laid down, 57 were harvested and the data from 48 used in the interpretation of results. Yield data was also obtained from the sites of 21 seed farms where the same varieties were being grown.

Sampling was not fully at random and so separate conclusions have been drawn for each of the four areas. Each area was divided into two strata, seed farms and field selection plots, both on cultivators' land, to note any variation in varieties grown by the two strata.

Results are summarised in Table VIII.

The general conclusions which can be drawn from these results are:—

- (a) Reyong 6 was superior to and significantly outyielded local varieties in the Central West coastal region of Malacca, and
- (b) Serendah Kuning was superior to and significantly outyielded local varieties in the inland district of Jasin.

As in the case of the South Krian trial, the need for re-distribution and standardisation of varieties according to the ecological conditions which are present is emphasized.

The seed farms in the Central West and Jasin areas also gave an indication of the superiority of varieties under test, although significance did not quite reach the 5 per cent. point.

In the Central East district, Reyong 6 in field selection plots and seed farms gave insignificant increases over local varieties.

In the field selection plots sited in Alor Gajah District, Serendah Kuning was slightly inferior, though not by any means significantly so.

Due to high error variances in the Central East and Alor Gajah Districts, significant results were not obtained.

Table VIII.
Yields of Padi in Malacca.
(Gantangs per Acre).

District.	Variety.	No. of Seed Farms.	No. of Field Selection Plots.	Average Yield.		Mean Difference.	Per cent. Increase.	t.
				Depart- mental Varieties.	Local Varieties.			
Central East	Reyong 6	5	—	340.0	332.0	+ 8.0	2.41	0.185
"	"	—	9	444.4	407.8	+ 36.6	8.90	1.217
Central West	"	5	—	540.0	492.0	+ 48.0	9.75	1.986
"	"	—	15	499.3	434.7	+ 64.6	14.86	2.699
Jasin	Serendah Kuning	4	—	620.0	435.0	+ 185.0	29.83	2.576
"	"	—	11	454.5	372.7	+ 81.8	21.95	3.073
Alor Gajah	"	3	—	466.7	413.3	+ 53.4	15.34	0.888
"	"	—	13	356.2	366.9	— 10.7	— 2.71	— 0.653

Names of local varieties were not recorded and it is probable that in Alor Gajah District, Serendah Kuning was being tested against local planter-selected Serendah Kuning. A situation similar to that experienced with Seri Raja in the Selinsing district of Perak is envisaged.

Summary and Discussion.

The method used to conduct varietal extension trials in Perak and Malacca is given.

Seri Raja was superior to local varieties in the Bagan Serai and Bariah Districts of South Krian, Perak, and gave an insignificant increase in yield in the Semanggol District.

Reyong 6 was significantly superior in yield to local varieties in the Central West District of Malacca, and its superiority was also indicated in the Central East District, even though significant results were not obtained.

Serendah Kuning significantly outyielded local varieties in Jasin District.

It is evident that standardisation of varieties according to ecological areas can do much to increase the present yield of padi.

Acknowledgements.

Acknowledgement is made to the members of the Department of Agriculture who undertook the execution and recording of these trials, and to the Statistician for his help and advice in the interpretation of the results.

HYBRID VIGOUR IN RICE

BY

F. B. BROWN,

Botanist.

The expression of hybrid vigour or heterosis is a phenomenon long recognised in plants and animals. The most spectacular use of it in a controlled form is found in the production of hybrid maize in the United States of America, and this is one of the most far-reaching achievements of plant breeding and applied genetics of recent years. Hybrid vigour has also been exploited in several asexually propagated crops, notably potatoes and sugar cane.

As hybrid vigour shows its maximum effect in the first filial generation, F_1 , it is necessary to repeat a cross for each annual or perennial plant. Commercial utilization of the phenomenon is therefore not practical in the case of crops such as rice but, for academic interest, the study is of value.

Despite the importance and easy recognition of heterosis there is still no fully acceptable explanation although hypotheses have been advanced from time to time. Of these theories, it is most probable that no single one is conclusive but that one or more or all may be complementary in action. Heterozygosity-effects, linked dominant genes favourable to development, suppression of unfavourable recessives and multiple allelic action may all influence and be part of the final effect.

Previous workers have found that heterosis in plants may be exhibited as any one or more of the following characters:—

- (a) An increase in general vegetative vigour.
- (b) Greater height of plant and girth of stems.
- (c) More branching.
- (d) Larger or more leaves.
- (e) Heavier yield. (Increased yield may be caused by either increases in the sizes of fruits or seeds or by the production of a larger number of them).
- (f) Increased root development.
- (g) Greater resistance to lodging, resulting from greater girth of stems etc.
- (h) Longer life.
- (i) Greater resistance to pests, disease or adverse conditions.

The study of hybrid vigour in rice has been attempted by only a few workers. The work that has been done has shown the existence of heterosis in the form of increased yield, greater number of tillers and, sometimes, the production of taller plants. Ramiah and Ramaswamy, in India, found that hybrid seed, except in a few cases, and then only when the smaller grained of the two parents was used as the female,

was not of greater weight. They also concluded that in the crosses examined by them, the embryo size or amount of endosperm reserve in the seed could not account for the increased vigour of the hybrid material.

Varieties and Method.

The crosses of local varieties of rice (*Oryza sativa* var. *indica*) were made in 1951-52 and the hybrid seed sown in the 1952-53 season. Emasculation of the female parent was effected by cutting off the upper part of the floret and removing the undehisced anthers with forceps.

The 28 crosses used in the experiment were as follows:—

Kuatek	x	Acheh Puteh
"	x	Daron
"	x	Radin Siak 34
Nachin 11	x	Acheh Puteh
"	x	Bujang Berinai
"	x	Kuatek
"	x	Serendah Menengkebau
Radin China 4	x	Acheh Puteh
" "	x	Bujang Berinai
Radin Siak 34	x	Acheh Puteh
" "	x	Banyak Anak
Serendah Menengkebau	x	Acheh Puteh
" "	x	Siam 29
" "	x	Seri Panji
Acheh Puteh	x	Serendah Kuning
Banyak Anak	x	Geharu
" "	x	Nachin 11
" "	x	Radin China 4
Seri Panji	x	Banyak Anak
Reyong 6	x	Bujang Berinai
Bujang Berinai	x	Siam 29
Daron	x	Serendah Kuning
"	x	Siam 29
Geharu	x	Nachin 11
"	x	Radin Siak 34
"	x	Serendah Kuning
Haji Haroun	x	Reyong 6
Siam 29	x	Radin Siak 34

The data for parental features were obtained from selfed plants grown in the same plot, generally adjacent to the hybrids. Seed from which parental plants were grown received similar treatment to that used in the emasculation of the female parent of the cross in order to prevent differential treatment effects entering into the results. Both types of seed also received the same fungicidal treatment, and both were germinated under laboratory conditions. Transplanting was carried out at the same time and at the same planting distances.

The crosses from which data for this experiment were taken, were also part of a hybridisation project which was started in Malaya, the particular attributes of each variety being:

Kuatek	—	Easy threshing.
Acheh Puteh	—	Shorter maturation period and good yield.
Nachin 11	—	Good yield and adaptability.
Radin China 4	—	Good yield and adaptability.
Radin Siak 34	—	Shorter maturation period and good yield.
Serendah Menengkebau	—	Strong straw.
Serendah Kuning	—	Yield.
Banyak Anak	—	Tillering capacity.
Seri Panji	—	Tillering capacity and yield.
Reyong 6	—	Good yield and adaptability.
Siam 29	—	Good yield and good quality rice.
Daron	—	Shorter maturation period & adaptability to adverse conditions.
Haji Haroun	—	Short maturation period.
Bujang Berinai	—	Local resistance to adverse conditions.
Geharu	—	Local resistance to adverse conditions.

The Results.

PLANT HEIGHT.

Measurements were taken from the basal node to the base of the panicle of mature plants.

Table I.
Mean Height, in Inches, of F_1 and Parental Plants.

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	33	Acheh Puteh	52	42.5	39.0	— 3.5	8.24
2. Kuatek	33	Daron	38	35.5	35.0	— 0.5	1.41
3. Kuatek	33	Radin Siak 34	38	35.5	33.0	— 2.5	7.04
4. Nachin 11	50	Acheh Puteh	52	51.0	51.0	—	—
5. Nachin 11	50	Bujang Berinai	39	44.5	50.0	+ 5.5	12.35
6. Nachin 11	50	Kuatek	33	41.5	43.0	+ 1.5	3.61
7. Nachin 11	50	Serendah Menengkebau	38	44.0	40.0	— 4.0	9.09
8. Radin China 4	46	Acheh Puteh	52	49.0	54.0	+ 3.0	10.20
9. Radin China 4	46	Bujang Berinai	39	44.5	50.0	+ 5.5	12.36

(Contd.)

Table I—(contd.)

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
10. Radin Siak 34	38	Acheh Puteh	52	45.0	53.0	+ 8.0	17.78
11. Radin Siak 34	38	Banyak Anak	50	44.0	48.0	+ 4.0	9.09
12. Serendah Menengkebau	38	Acheh Puteh	52	45.0	38.0	— 7.0	15.56
13. Serendah Menengkebau	38	Siam 29	51	44.5	36.0	— 8.5	19.10
14. Serendah Menengkebau	38	Seri Panji	43	40.5	50.0	+ 9.5	23.46
15. Acheh Puteh	52	Serendah Kuning	39	45.5	47.0	+ 1.5	3.30
16. Banyak Anak	50	Geharu	37	43.5	48.0	+ 4.5	10.34
17. Banyak Anak	50	Nachin 11	50	50.0	52.0	+ 2.0	4.00
18. Banyak Anak	50	Radin China 4	46	48.0	52.0	+ 4.0	8.33
19. Seri Panji	43	Banyak Anak	50	46.5	43.0	+ 1.5	3.60
20. Reyong 6	48	Bujang Berinai	39	43.5	49.0	+ 5.5	12.60
21. Bujang Berinai	39	Siam 29	51	45.0	47.0	+ 2.0	4.40
22. Daron	38	Serendah Kuning	39	38.5	43.0	+ 4.5	11.70
23. Daron	38	Siam 29	51	44.5	38.0	— 6.5	14.61
24. Geharu	37	Nachin 11	50	43.5	44.0	+ 0.5	1.10
25. Geharu	37	Radin Siak 34	38	37.5	35.0	— 2.5	6.67
26. Geharu	37	Serendah Kuning	39	38.0	38.0	—	—
27. Haji Haroun	35	Reyong 6	48	41.5	47.0	+ 5.5	13.25
28. Siam 29	51	Radin Siak 34	38	44.5	48.0	+ 3.5	7.87

In this character there is no evidence of a general hybrid vigour effect. Within acceptable limits the height of the F_1 hybrid is rather equal to the average height of the parents or to the height of the female or male parent. In only three crosses (Serendah Menengkebau x Seri Panji, Daron x Serendah Kuning, and Radin China 4 x Bujang Berinai) was the height of the hybrid significantly greater than either of the parents. In 10 crosses the hybrid height was not significantly different from the average height of the parents, in 10 crosses not significantly different from the female parent and in five crosses from the male parent. These results do not show any striking dominance of tall over short or influence of the female parental type over the male.

NUMBER OF TILLERS PER PLANT.

Table II.
Mean Number of Tillers per Plant—Parental and Hybrids.

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	14.20	Acheh Puteh	23.14	18.67	22.24	+ 3.57	19.12
2. Kuatek	14.20	Daron	17.20	15.70	19.00	+ 3.30	21.02
3. Kuatek	14.20	Radin Siak 34	16.20	15.20	19.92	+ 4.72	31.05
4. Nachin 11	22.72	Acheh Puteh	23.14	27.93	33.57	+ 5.64	20.19
5. Nachin 11	22.72	Bujang Berinai	24.23	23.48	26.54	+ 3.06	13.03
6. Nachin 11	22.72	Kuatek	14.20	18.46	23.68	+ 5.22	28.28
7. Nachin 11	22.72	Serendah Menengkebau	16.20	19.46	24.83	+ 5.37	27.60
8. Radin China 4	23.10	Acheh Puteh	23.14	23.12	28.25	+ 5.13	22.19
9. Radin China 4	23.10	Bujang Berinai	24.23	23.67	26.18	+ 2.51	10.60
10. Radin Siak 34	14.00	Acheh Puteh	23.14	18.67	21.45	+ 2.78	14.89
11. Radin Siak 34	14.00	Banyak Anak	28.00	21.00	23.00	+ 2.00	9.52
12. Serendah Menengkebau	16.20	Acheh Puteh	23.14	19.67	20.30	+ 0.63	3.20
13. Serendah Menengkebau	16.20	Siam 29	29.20	22.70	28.10	+ 5.40	23.80
14. Serendah Menengkebau	16.20	Seri Panji	16.00	16.10	28.50	+ 12.40	77.02
15. Acheh Puteh	23.14	Serendah Kuning	15.42	19.28	24.86	+ 5.58	28.94
16. Banyak Anak	28.00	Geharu	18.70	23.35	33.64	+ 10.29	44.07
17. Banyak Anak	28.00	Nachin 11	22.72	25.36	30.15	+ 4.79	18.89
18. Banyak Anak	28.00	Radin China 4	23.10	25.55	28.00	+ 2.45	9.60
19. Seri Panji	16.00	Banyak Anak	28.00	22.00	26.74	+ 4.74	21.55
20. Reyong 6	17.17	Bujang Berinai	24.23	20.70	22.75	+ 2.05	9.90
21. Bujang Berinai	24.23	Siam 29	29.20	26.72	28.76	+ 2.04	8.63
22. Daron	17.20	Serendah Kuning	15.42	16.31	17.58	+ 1.27	7.80
23. Daron	17.20	Siam 29	29.20	23.20	25.00	+ 1.80	7.85
24. Geharu	18.70	Nachin 11	22.72	20.71	27.85	+ 7.14	34.48
25. Geharu	18.70	Radin Siak 34	14.00	16.35	30.82	+ 14.47	88.51
26. Geharu	18.70	Serendah Kuning	15.42	17.06	25.33	+ 8.27	48.48
27. Haji Haroun	10.40	Reyong 6	17.17	13.79	18.89	+ 5.10	36.98
28. Siam 29	29.20	Radin Siak 34	14.00	21.60	30.87	+ 9.27	42.92

It will be seen from Table II that a significant increase in number of tillers per plant is apparent in all crosses. The mean increase for all the crosses is 5.04 tillers per plant, the limits of increase being from 0.63 to 14.47. These results agree with those obtained by other investigators.

YIELD.

Table III.
Mean Yield in Grammes per Plant—Parents and Hybrids.

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	49.66	Acheh Puteh	67.42	58.54	56.00	+ 7.46	12.74
2. Kuatek	49.66	Daron	44.30	46.98	72.57	+25.59	54.47
3. Kuatek	49.66	Radin Siak 34	42.32	45.99	100.25	+54.26	118.98
4. Nachin 11	55.08	Acheh Puteh	67.42	61.25	94.42	+33.17	54.16
5. Nachin 11	55.08	Bujang Berinai	75.41	65.50	117.91	+52.41	80.02
6. Nachin 11	55.08	Kuatek	49.66	52.37	104.65	+52.28	99.83
7. Nachin 11	55.08	Serendah Menengkebau	36.00	45.54	104.94	+59.40	130.43
8. Radin China 4	64.50	Acheh Puteh	67.42	65.96	76.25	+10.29	15.61
9. Radin China 4	64.50	Bujang Berinai	75.41	69.96	93.10	+23.14	33.08
10. Radin Siak 34	42.32	Acheh Puteh	67.42	54.87	80.66	+24.79	45.18
11. Radin Siak 34	42.32	Banyak Anak	76.00	59.16	75.61	+16.45	28.92
12. Serendah Menengkebau	36.00	Acheh Puteh	67.42	51.71	82.30	+30.59	59.16
13. Serendah Menengkebau	36.00	Siam 29	106.90	71.45	102.90	+31.45	44.02
14. Serendah Menengkebau	36.00	Seri Panji	45.00	40.50	78.81	+38.31	94.59
15. Acheh Puteh	67.42	Serendah Kuning	51.06	59.24	73.24	+14.00	23.63
16. Banyak Anak	76.00	Geharu	54.30	65.15	80.35	+15.20	23.33
17. Banyak Anak	76.00	Nachin 11	55.08	65.54	84.48	+18.94	29.00
18. Banyak Anak	76.00	Radin China 4	64.50	70.25	85.86	+15.61	22.22
19. Seri Panji	45.00	Banyak Anak	76.00	60.50	68.14	+ 7.64	12.63
20. Reyong 6	58.67	Bujang Berinai	75.41	67.04	118.86	+51.82	77.30
21. Bujang Berinai	75.41	Siam 29	106.90	91.16	107.00	+15.84	17.38
22. Daron	44.30	Serendah Kuning	51.06	47.68	64.56	+16.88	35.41
23. Daron	44.30	Siam 29	106.90	75.60	82.50	+ 6.90	9.13
24. Geharu	54.30	Nachin 11	55.08	54.69	71.25	+16.56	30.28

(Contd.)

Table III—(contd.)

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
25. Geharu	54.30	Radin Siak 34	42.32	48.31	66.38	+18.07	37.41
26. Geharu	54.30	Serendah Kuning	51.06	52.68	60.55	+ 7.87	14.94
27. Haji Haroun	38.00	Reyong 6	58.67	48.34	69.43	+21.09	43.63
28. Siam 29	106.90	Radin Siak 34	42.32	74.61	121.00	+46.39	62.18

One of the established correlations in rice is that between number of tillers and yield, and the results above are therefore not unexpected, after consideration of Table II.

In all 28 crosses there is a significant increase in yield, the limits of increase being from 9.1 to 130.5 per cent. These results are also in full agreement with those of Ramiah *et alia*.

PERIOD FROM SOWING TO FLOWERING.

Table IV.

Number of Days from Sowing to Flowering—Parents and Hybrids.

Female Parent	Days	Male Parent	Days	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	153	Acheh Puteh	142	147.5	153	+ 5.5	3.7
2. Kuatek	153	Daron	147	150.0	140	—10.0	6.7
3. Kuatek	153	Radin Siak 34	150	151.5	156	+ 4.5	2.9
4. Nachin 11	178	Acheh Puteh	142	160.0	172	+12.0	7.51
5. Nachin 11	178	Bujang Berinai	171	174.5	174	— 0.5	0.3
6. Nachin 11	178	Kuatek	153	165.5	166	+ 0.5	0.3
7. Nachin 11	178	Serendah Menengkebau	150	164.0	160	— 4.0	3.4
8. Radin China 4	173	Acheh Puteh	142	157.5	172	+14.5	9.2
9. Radin China 4	173	Bujang Berinai	171	172.0	174	+ 2.0	0.5
10. Radin Siak 34	150	Acheh Puteh	142	146.0	130	—16.0	11.0
11. Radin Siak 34	150	Banyak Anak	169	159.5	157	— 1.5	1.6
12. Serendah Menengkebau	150	Acheh Puteh	142	146.0	150	+ 4.0	2.7
13. Serendah Menengkebau	150	Siam 29	172	161.0	155	+ 6.0	3.7
14. Serendah Menengkebau	150	Seri Panji	185	167.5	183	+15.5	9.3

(Contd.)

Table IV.—(contd.)

Female Parent	Days	Male Parent	Days	Mean of Parents	Mean of Cross	+or—	Per Cent.
15. Aceh Puteh	142	Serendah Kuning	169	155.5	147	— 8.5	5.5
16. Banyak Anak	169	Geharu	168	168.5	170	+ 1.5	0.9
17. Banyak Anak	169	Nachin 11	178	173.5	170	— 3.5	2.0
18. Banyak Anak	169	Radin China 4	173	171.0	171	—	—
19. Seri Panji	185	Banyak Anak	169	177.0	155	—22.0	12.4
20. Reyong 6	168	Bujang Berinai	171	169.5	168	— 1.5	0.9
21. Bujang Berinai	171	Siam 29	172	171.5	169	— 2.5	0.9
22. Daron	147	Serendah Kuning	169	158.0	161	+ 3.0	1.9
23. Daron	147	Siam 29	172	159.5	155	— 4.5	2.8
24. Geharu	168	Nachin 11	178	172.0	167	— 5.0	2.9
25. Geharu	168	Radin Siak 34	150	159.0	171	+12.0	7.5
26. Geharu	168	Serendah Kuning	169	168.5	172	+ 3.5	2.1
27. Haji Haroun	126	Reyong 6	168	147.0	127	—20.0	13.6
28. Siam 29	172	Radin Siak 34	150	161.0	160	— 1.0	0.6

From Table IV it can be seen that there are three crosses which have a significantly shorter period from sowing to flowering than their parents; these are Kuatek x Daron, Radin Siak 34 x Aceh Puteh, and Seri Panji x Banyak Anak. Of the remaining 25 crosses, 13 show a period similar to the average of the parents, 11 similar to the female parent and one similar to the male parent. It appears therefore that hybrid vigour may in some cases be expressed as a shortening of the period sowing to flowering, but this effect is not universal.

PERIOD FROM SOWING TO MATURITY.

Table V.
Mean Maturation Period in Days—Parents and Hybrids.

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	176	Acheh Puteh	176	176	174	— 2	1.15
2. Kuatek	176	Daron	191	184	177	— 11	5.97
3. Kuatek	176	Radin Siak 34	176	176	187	+ 11	6.25
4. Nachin 11	207	Acheh Puteh	176	192	188	+ 7	3.64

(Contd.)

Table V.—(contd.)

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
5. Nachin 11	207	Bujang Berinai	198	203	219	+ 16	7.88
6. Nachin 11	207	Kuatek	176	192	194	+ 2	1.04
7. Nachin 11	207	Serendah Menengkebau	176	192	194	+ 2	1.04
8. Radin China 4	219	Acheh Puteh	176	198	199	+ 1	0.49
9. Radin China 4	219	Bujang Berinai	198	209	207	— 2	0.96
10. Radin Siak 34	176	Acheh Puteh	176	176	165	— 11	6.25
11. Radin Siak 34	176	Bujang Berinai	206	191	187	— 4	2.09
12. Serendah Menengkebau	176	Acheh Puteh	176	176	176	—	—
13. Serendah Menengkebau	176	Siam 29	200	188	194	+ 6	3.19
14. Serendah Menengkebau	176	Seri Panji	219	198	219	+ 21	10.61
15. Acheh Puteh	176	Serendah Kuning	199	188	176	— 12	6.38
16. Banyak Anak	206	Geharu	199	203	199	— 4	1.97
17. Banyak Anak	206	Nachin 11	207	207	199	— 8	3.86
18. Banyak Anak	206	Radin China 4	219	213	206	— 7	3.29
19. Seri Panji	219	Banyak Anak	206	213	219	+ 6	2.82
20. Reyong 6	199	Bujang Berinai	198	199	199	—	—
21. Bujang Berinai	198	Siam 29	200	199	199	—	—
22. Daron	191	Serendah Kuning	199	194	187	— 7	3.61
23. Daron	191	Siam 29	200	195	176	— 19	9.70
24. Geharu	199	Nachin 11	207	203	199	— 4	1.97
25. Geharu	199	Radin Siak 34	176	188	199	+ 11	5.85
26. Geharu	199	Serendah Kuning	199	199	207	+ 8	4.02
27. Haji Haroun	169	Revong 6	199	184	169	— 15	8.15
28. Siam 29	200	Radin Siak 34	176	188	194	+ 6	3.19

The results show that in 14 crosses the maturation period was not significantly different from the average maturation period of the parents. In three crosses it was significantly greater than either parent (Kuatek x Radin Siak 34, Nachin 11 x Bujang Berinai, Geharu x Serendah Kuning), in three crosses it was significantly less than either parent (Radin Siak 34 x Acheh Puteh, Banyak Anak x Nachin 11, Daron x Siam 29), and in seven it resembled the female parent and in one the male

parent. It appears therefore that there is no general heterotic effect which may be expressed as a lengthening or shortening of total maturation period.

WEIGHT OF 100 GRAINS.

Measurements were only made in 22 crosses.

Table VI.

100 Grain Weight in Grammes—F₁ Hybrids and Parents.

Female Parent	Mean	Male Parent	Mean	Mean of Parents	Mean of Cross	+or—	Per Cent.
1. Kuatek	1.70	Daron	1.43	1.55	1.56	+ 0.01	0.65
2. Kuatek	1.70	Radin Siak 34	0.86	1.28	2.30	+ 1.02	79.70
3. Nachin 11	1.45	Acheh Puteh	1.94	1.70	2.25	+ 0.55	32.40
4. Nachin 11	1.45	Bujang Berinai	2.81	2.13	2.20	+ 0.07	0.31
5. Nachin 11	1.45	Kuatek	1.70	1.58	1.70	+ 0.12	7.60
6. Nachin 11	1.45	Serendah Menengkebau	1.27	1.36	1.43	+ 0.07	5.10
7. Radin China 4	0.94	Bujang Berinai	2.81	1.88	1.68	— 0.20	10.60
8. Radin Siak 34	0.86	Acheh Puteh	1.94	1.40	1.52	+ 0.12	8.60
9. Radin Siak 34	0.86	Banyak Anak	1.53	1.20	1.22	+ 0.02	1.70
10. Serendah Menengkebau	1.27	Siam 29	1.64	1.46	1.54	+ 0.08	5.50
11. Serendah Menengkebau	1.27	Seri Panji	1.97	1.62	1.38	— 0.24	14.80
12. Acheh Puteh	1.94	Serendah Kuning	1.34	1.64	1.70	+ 0.06	3.70
13. Banyak Anak	1.53	Geharu	2.10	1.82	1.82	—	—
14. Banyak Anak	1.53	Radin China 4	0.94	1.24	1.70	+ 0.46	37.10
15. Reyong 6	2.58	Bujang Berinai	2.81	2.70	1.38	— 1.32	48.90
16. Bujang Berinai	2.81	Siam 29	1.64	2.23	1.13	— 1.10	49.30
17. Daron	1.43	Serendah Kuning	1.34	1.39	1.40	+ 0.01	0.72
18. Geharu	2.10	Nachin 11	1.45	1.78	1.48	— 0.30	16.90
19. Geharu	2.10	Radin Siak 34	0.86	1.48	1.60	+ 0.12	8.10
20. Geharu	2.10	Serendah Kuning	1.34	1.72	1.92	+ 0.20	11.60
21. Haji Haroun	2.75	Reyong 6	2.58	2.67	2.04	— 0.63	23.70
22. Siam 29	1.64	Radin Siak 34	0.86	1.25	1.65	+ 0.40	32.00

The results from these observations are again inconclusive. In five crosses there is a highly significant increase, in six a significant decrease in 100 grain weight. The remainder, with one exception

(Banyak Anak x Geharu), all show insignificant increases to a greater or less degree.

In those five crosses showing the increase, the female parent possessed the greater grain weight in four cases; in the six crosses showing a decrease the heavier grained parent was in three cases the female, and in three cases the male.

It appears therefore that the weight of the hybrid seed is greater only in a few instances, and that the grain weight of the female parent does not condition an increase.

Summary.

The expression of hybrid vigour has been studied in 28 crosses between Malayan varieties of rice.

The number of tillers per plant and yield in grammes per plant of the F_1 hybrids shows a very significant increase over the corresponding figures for the parents.

In the other characters studied, viz. plant height, period from sowing to flowering, and 100 grain weight, hybrid vigour is exhibited only in a few cases. The form of the female parent does not seem to influence the form of the F_1 hybrid to a great degree.

PINEAPPLE VARIETIES AND SELECTION IN MALAYA

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Introduction.

The pineapple (*Ananas comosus* Merr.) was first known in Malaya in the sixteenth century. The method by which it reached this country is not traceable but it is almost certain that it was brought by the Portuguese, the local name 'nanas' corresponding with the name 'nana' used in its natural habitat, Brazil, from where the Portuguese first collected material.

It appears to have survived in small-scale cultivation on Singapore Island and probably Malacca until the latter half of the nineteenth century when some European firms commenced the canning industry. There was no great development of this, however, till about 1890, when Chinese commenced to take an interest in the business. Larger crops were interplanted among coconuts, areca palms and fruit trees, and subsequently when widespread extensions of rubber planting were taking place about 1920, pineapple cultivation was introduced to other regions, chiefly south Johore.

The main object in interplanting with pineapple was to provide a cash income until the rubber was ready for tapping, and therefore methods of cultivation and yield were only secondary considerations. Fruit prices were very low but even so pineapple growing showed some return, besides providing a saving in weeding and cultivation charges on the rubber. The large surplus of fruit other than that which was needed for consumption as fresh fruit prompted the establishment of the pineapple canning industry at this period.

The onset of the slump period for rubber in 1931 was the real beginning of the modern pineapple industry. Up to this time there were very few places where the fruit was grown as a sole crop, but with the cessation of rubber expansion, plantations were a necessity if the canning industry was to survive. Consequently large areas of jungle were cleared and planted with pineapple. Unfortunately most of this planting was entirely indiscriminate and totally unsuitable areas such as steep hillsides were planted with the crop. The price of the fruit remained low and gave to the growers a margin of profit insufficient for them to pursue adequate cultivation and manurial practices, or soil conservation precautions. Legislation to protect the land was passed too late and less productive areas reverted to *lalang** and *belukar***. A policy of non-alienation of hilly land for pineapple cultivation was adopted from 1938

* *Imperata cylindrica*.

** Secondary jungle growth.

with a result that the growers began to migrate to the peat lands of the Pontian district of Johore. Meanwhile, the price of land on Singapore Island had increased greatly and the total acreage of pineapples fell rapidly until only 800 acres remained.

The industry virtually ceased during the initial period of the occupation of Malaya by the Japanese because of the wholesale abandonment of the fields following outrages in south Johore, the clearing of the land for tapioca growing and the establishment of a pineapple fibre industry.

The demand by the Japanese military for fresh fruit, and hence an attractive price, led to the re-establishment of some areas with the Mauritius pineapple, but it was not until the liberation of Malaya that once again the canning industry was re-established and large-scale growing of the fruit on the peat lands commenced.

To-day there exists an efficient and modernised processing side to the industry and it has become essential to provide an increasing amount of fruit to enable cost of production of the canned product to remain at an economic level. Hitherto the availability of land and cost of bringing it into production were minor considerations; the reverse is now the case and increased costs in all aspects have made it essential to obtain increased output from plantations. The use of fertilisers, better cultural practices and, more recently, hormones to produce simultaneous fruiting are the chief ways in which yield can be raised and cost of production lowered, but in order to obtain maximum benefit it is essential that the planting material should be uniform and of the best quality. In order to provide this, the Department of Agriculture has embarked on a selection project the aims of which are set out in the following paragraphs.

Varieties and Selection.

In selection of pineapples one must (a) examine the material available to assess whether the degree of variation is sufficient to warrant selection; (b) define the requirements; (c) examine the methods by which the goal may be reached. These three points are now discussed.

MALAYAN VARIETIES.

The varieties of pine which are immediately available are the Singapore Spanish, the Mauritius and the Sarawak and various strains of each variety. A description of each of these varieties is given below.

(1) *The Singapore Spanish Pine.* (Singapore, Singapore Canning).

LEAVES.

Long, straight, narrow (1 to 2 ins.), tapering from the base, dark-green above often with a reddish strip along the edges, glabrous above often glaucous beneath. A very few spines only are often present, especially near the leaf apex (spines—eight to an inch, small and generally

red). Leaves tend to be limpish and spreading, and there are 40 to 50 in a mature plant.

SUCKERS.

One to three ground suckers; one or two aerial suckers.

BASAL SLIPS.

Nought to 15 produced below the fruit; 4 to 24 ins. long.

CROWN.

Four to 12 ins. long (cocks-comb crown common), leaves smooth, glabrous above, glaucous below, and dark-green in colour.

FLOWERS.

Purple, six to 12 opening each day.

FRUIT.

Medium size; first and second crops $3\frac{1}{2}$ to 5 lbs., later crops 1 to 4 lbs. Blunt cylindrical in shape. Colour changing from red to dark-olive to orange when ripe.

EYES.

Seventy to 110 well defined, sometimes rectangular, slightly prominent, raised at the edges, centrepoinť well defined, short and blunt. Long-pointed bracts well developed covering a third to half an eye. Eyes fairly deep.

FLESH.

Pale to golden when mature, juicy, fibrous, rich sweet, with a 'bite' when ripe. Good quality. Core is fairly small.

NORMAL MATURATION PERIOD.

Suckers	—	12 to 18 months.
Basal slips	—	15 to 18 months.
Crowns	—	18 to 21 months.

Plate I shows a typical fruit.

Common Strains of the Local Singapore Spanish Pine According to Vegetative Growth.

The Green Selangor. (Selangor Green, Selassie, Green Spanish).

This pine has the same general appearance as the Singapore Spanish and is probably a mutant. It is much paler in appearance and no red colouration is ever present. Leaves usually have a few spines at the tips—more than occur on leaves of the Singapore Spanish. Flowers

are white or yellow, sometimes purple. The fruit is light-green changing to yellow when mature. The flesh is pale and less fibrous than the Singapore Spanish.

Strain A.

Stem short; leaves smooth, broad, long and erect. Heart leaves few and large. Spines few on tips of leaves. This type is generally early fruiting.

Strain B.

Stem long; leaves smooth, broad, long, erect and many. Heart leaves many and small. Spines few on tips of leaves.

Strain C.

Stem long; whorls of leaves many. Leaves smooth, broad, long, erect and many. Heart leaves large. Spines red only at base of leaves. This type is generally late fruiting.

Strain D.

Stem long; whorls of leaves many. Heart leaves small. Leaves smooth, broad, long and large. Leaves curl, tips spineless.

(2) *Mauritius.* (*Malacca Queen, Ceylon, Red Ceylon, Malacca, Red Malacca.*)

PLANTS.

Small and compact.

LEAVES.

Dark-green, fairly long and narrow, centre of leaf generally with a reddish strip which may or may not also be present at the edges of the leaf. Many red spines on leaf edges. Leaf tapers in apical region. Forty-five to 60 leaves in the mature plant. Glabrous with slight 'bloom' above, glaucous beneath.

CROWN.

Small to medium in size, compact, very many small leaves, green with narrow, red strip at edges.

Red spines very numerous on leaf edges.

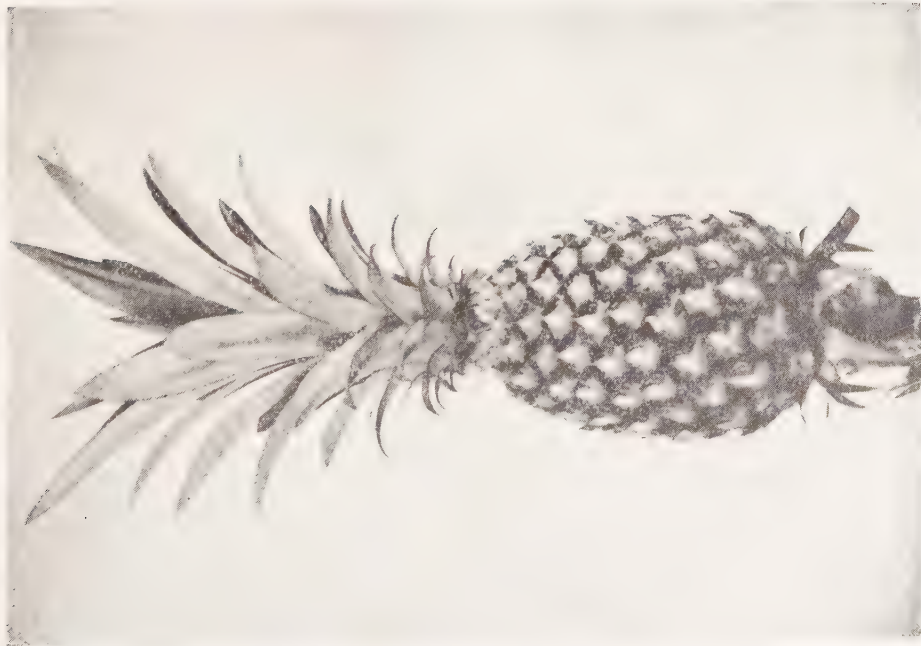
SUCKERS.

Very numerous.

BASAL SLIPS.

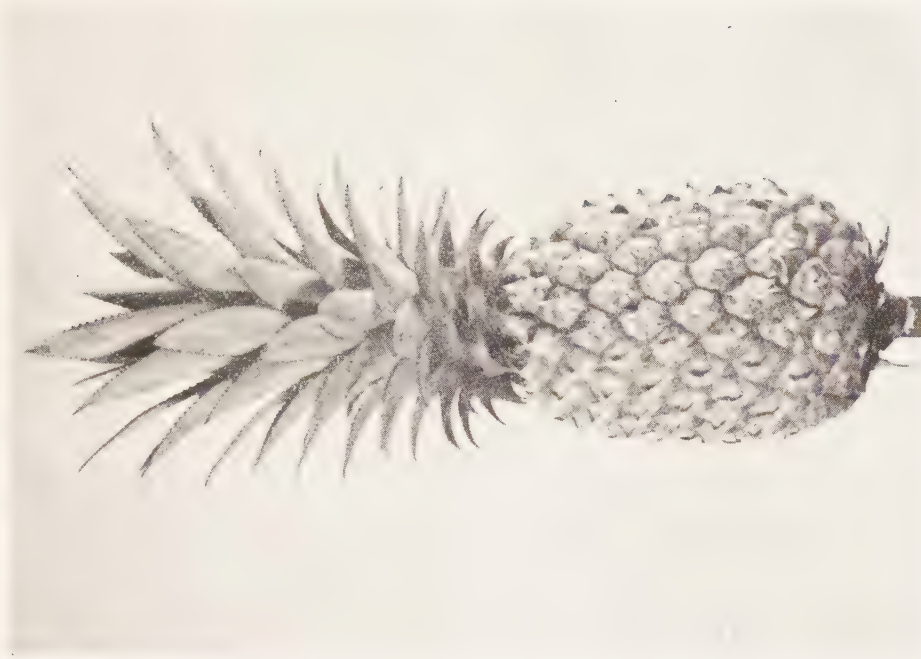
Absent.

PLATE I.



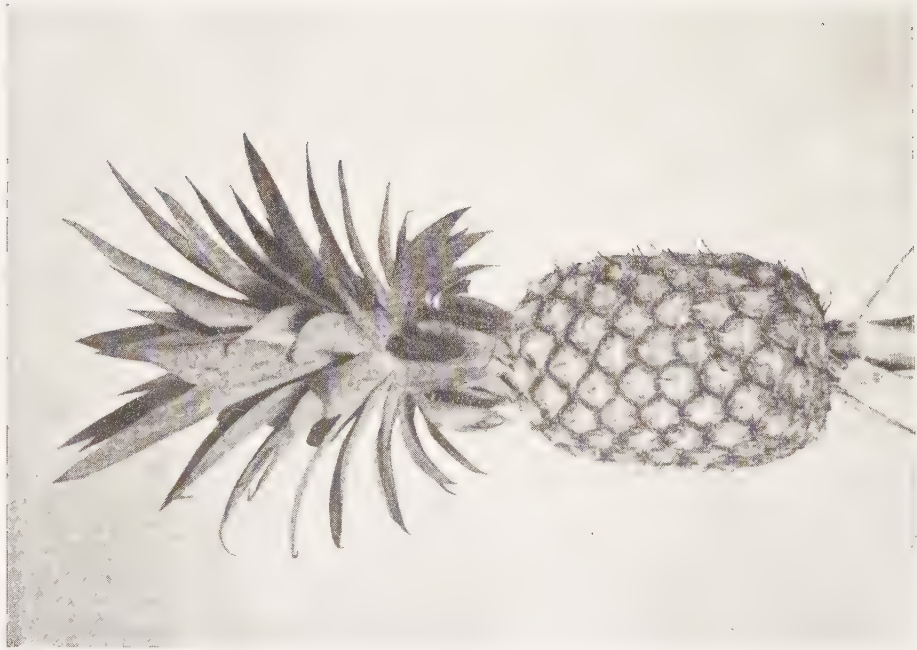
A Singapore Spanish Pineapple.
Weight $4\frac{1}{2}$ lbs; length of fruit 7 ins.

PLATE II.



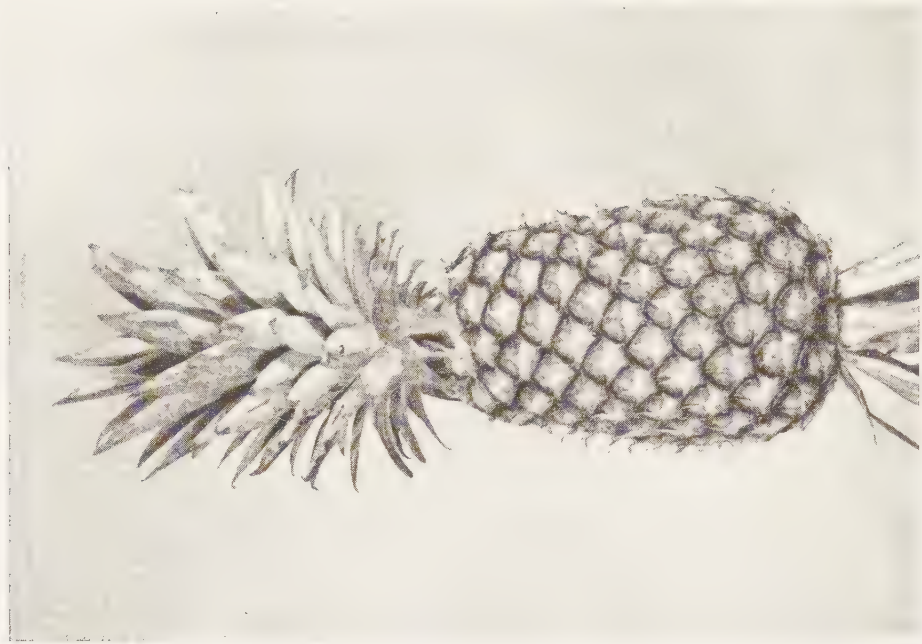
A Mauritius Pineapple.
Weight $2\frac{1}{4}$ lbs; length of fruit 6 ins.
Both pineapples were grown at the Federal Experiment Station, Jalan Kebun, Selangor.

PLATE III.



A Sarawak Pineapple.
Weight 5 lbs; length of fruit 7 ins.

PLATE IV.



A 'Giant' Sarawak Pineapple.
Weight 12 lbs; length of fruit 12 ins.
Both pineapples were grown at the Federal Experiment Station, Jalan Kebun, Selangor.

FLOWERS.

Violet in colour.

FRUIT.

Dark-green with powdery bloom, to bright-yellow when ripe, 1 to 3½ lbs. Conical to cylindrical in shape.

EYES.

Prominent (Queen type), 130 to 170 rising from the edges, small, irregularly angular, "bloomy", shallow. Red-yellowish turning to white, bracts cover one-third of eye. Bracts long, pointed and spiny.

FLESH.

Spongy; yellow when ripe; fibrous, pleasantly sweet, crisp agreeable flavour. Core small.

NORMAL MATURATION PERIOD.

Suckers	—	12 to 15 months.
Crowns	—	18 to 21 months.

(3) *Sarawak. (Smooth Cayenne, Kew).*

The original planting material of the Sarawak pine came East from Kew about 1850 and was of the same stock as the original plants (Smooth Cayenne) which were supplied to Hawaii.

The main type is a vigorous plant generally slightly larger but otherwise similar in appearance to the Singapore Spanish with long, stiff, smooth, straight leaves; but a plant with tree-like habit of growth, a thick stem often 5 to 6 ft. in height, with short, pliant, curved leaves and often bearing an enormous fruit is also encountered (possibly a tetraploid).

LEAVES.

Tapering in apical portion, occasionally a few red spines at the leaf tips. Generally a wide, central red strip.

CROWN.

Medium to large (8 to 18 ins.), often spiny when young—young leaves often have red tips. Leaves glabrous above, glaucous below, generally with a central or marginal reddish strip.

SUCKERS.

Ground suckers two to three. Aerial suckers one to two.

BASAL SLIPS.

These are not normally produced but certain strains may give two to eight at the base of the fruit.

FLOWERS.

Light purple or violet; bracts bright-red.

FRUIT.

From normal plants an average of 6 lbs. Generally cylindrical or conical.

Tree-type plants produce fruits from 5 to 25 lbs. in weight.

EYES.

From 120 to 180 flat Cayenne type; one-third covered by long, pointed, spiny bracts.

FLESH.

Pale-yellow, juicy, rich and sweet when fully ripe; texture variable sometimes firm and uniform but may also be coarse and fibrous with large vacuolar cavities. Core is large.

NORMAL MATURATION PERIOD.

Suckers	—	18 to 24 months.
Basal slips	—	21 months.
Crowns	—	24 months.

SELECTION.

The majority of commercial or cultivated pineapple varieties are highly self-sterile and produce few seeds, and, on account also of their heterozygosity, multiplication of a crop of these cultivated varieties can only be satisfactorily accomplished by vegetative means. This is done by planting suckers, slips and crowns, all of which arise from the parent stem and therefore possess characters identical with those of the parent.

There is observably, nevertheless, much variation of plant and fruit characters; much of this is due to environmental effects, and to vigour of planting material and mechanical injuries, but bud-sports and chance seedling variations also occur. Bud sports or mutations which also differ from the parents must occur fairly frequently, and these variations are carried on by vegetative propagation. In addition, although fairly highly self-sterile, a few seeds are always found in fruits of the Singapore Spanish pineapple. Chance sown seedlings inevitably occur from discarded fruits, and as seedlings do not breed true to type so further variations also arise.

Most of the variations which arise by mutation are, presumably, so small that immediate recognition is not possible; others may be apparent at once. By vegetative propagation any genetic differences are automatically carried forward, with the result that varieties may undergo gradual and continuous changes in successive crops. Those types which produce slips freely are likely to be propagated the fastest and hence there will be accidental or natural selection of such types.

Environmental conditions and cultural practices may favour the multiplication of undesirable mutants which in the course of time could become the dominant strain and the original varietal type be lost. This emphasizes the importance of using only the best planting material from reliable sources.

This natural selection accounts for the divergences which have occurred in the same varieties grown in different countries although the original planting material may have been of the same stock. Modifications in cultural practices are very important factors in the development of these varietal strains; the opening of the peat lands in south Johore called for a large increase in planting slips and the strains producing large numbers of slips are very evident there. The plants grown in south-east Johore before the war are said to have produced fewer but better slips. It is possible, of course, that the mineral content of these slips, which were grown on these quartzite clay soils, is greater than that of slips from the peat soils, and the initial growth consequently better. It will be apparent that a gradual divergence from type may occur even if no deliberate selection takes place. This divergence has taken place in Malaya, and to-day the plantations contain several to many strains. It is not easy without systematic examination to estimate how many strains there may be, as genetic variation is masked or exaggerated by variations due to environmental effects. The course now open is to attempt to select the most desirable type, both from growers' and canners' points of view, from the very mixed population now present. It must be mentioned that the most conspicuous divergent fruit types are not improvements. Such plants may be derived from recent seedlings as well as mutants.

Characters which should be considered in selection of plants are:—

- (a) vigour and growth habit;
- (b) production of sufficient propagating material;
- (c) disease resistance;
- (d) uniformity;
- (e) fruit characters.

To some extent, variations which do not alter the productivity of the plant may be ignored. Characters (a) to (d) above are considerations from the growers' point of view alone. From successful selection it is desirable to distinguish between hereditary and environmental variations. It is not always possible to do this as both may exhibit the same effect.

The canner requires the following characters in the fruits:—

- (1) eyes as shallow as possible to reduce loss in cutting;
- (2) a diameter of 4 to 5 ins.;
- (3) shape, rectangular or slightly oval;
- (4) fruits as long as possible within the limits of (2) and (3);
- (5) a small core (normal in Singapore Spanish);
- (6) a less fibrous texture and slightly more acidity than is common to the Singapore Spanish pineapple;
- (7) a good colour and relative absence of air cells (flecks);

- (8) a tendency to acquire some flavour as early as possible during the final ripening stage, that is as the colour changes over before the final softening; normally the Singapore Spanish is practically tasteless right up to the "Golden" stage.

It is with these aims in view that large numbers of clones have been established in Malaya. Preliminary selection to discard undesirable types in vegetative growth are taking place.

HYBRIDIZATION.

Because of the unexplored field for improvement in the Singapore Spanish pine by selection within the present population, no large-scale programme involving hybridization is yet contemplated here.

UNDESIRABLE CHARACTERS.

The growers of pineapples in Malaya can do much to improve their present plantations by elimination of obviously inferior types. Such roguing is habitually done, especially by Chinese smallgrowers, at harvest. The most common bad characters and the most easy to discern are:—

(1) *Collar of Slips and Near Collar of Slips.*

The basal slips instead of being on the peduncle below the fruit are fused to and appear to grow out of the base of the fruit itself. The number of slips produced is generally many more than is normal. Fruits are often mis-shapen and are almost useless for canning.

(2) *Spiny Leaves.*

These are in contrast to the normal smooth or nearly smooth leaves. This type should be rogued out of the crop as soon as it appears.

(3) *Multiple and Fasciated Crowns.*

These may be of various types.

(a) 2, 3, 4 or many separate crowns.

(b) 2, 3, 4 or many fused crowns.

Where many crowns are fused the upper part of the fruit may also be branched. It is thought that where crowns are fused, the variation is not inheritable, but that the expression of two or more separate crowns is hereditary. This point is under investigation but it is advisable to regard all multiple crowned fruits as suspect and to refrain from using slips from them for propagation.

Objectionable Fruit Types.

(4) *Dry, Bottle-neck and Cannon-ball Fruits.*

The first is a variant in which the normal fruit does not develop but is replaced by swollen bracts and a core only. In bottle-neck fruits, parts (generally basal) may develop normally but the remainder grows

as a dry fruit. Plants which produce dry and bottle-neck fruits are generally dwarfed or stunted.

In the cannon-ball fruit the local florets develop normally but the apical ones wither and do not form a neck as in bottle-neck fruits. These variations are hereditary and can be eliminated by destruction of plants.

(5) *Slender Fruit.*

This is especially common in Sarawak pines and is characterised by the small diameter as compared with the length. In addition, the fruit is generally pyramidal in shape and is almost worthless for canning as slices.

Fruits may consist of a few eyes only, the rest being replaced by leaves, or the whole fruit may be represented by a rosette of leaves.

Double fruits, with each one having one or more crowns, may also be found.

Propagation of Desirable Types.

There are several methods of accomplishing rapid multiplication of selected plants, in addition to the normal planting of slips, suckers and crowns. These methods are:—

(1) *Stem-slice Method.*

A main stem or large sucker is stripped of its leaves and the apical portion (approximately 20 per cent.) is discarded. The remainder is cut into discs $\frac{1}{2}$ to $\frac{3}{4}$ in. thick, each disc having three to four "eyes". The discs are washed in 2 per cent. potassium permanganate solution for two minutes then left to dry in the sun. They should then be placed on a raised bed of washed sand, although peat or potting soil may be used, and protected against sun and rain with some overhead cover. The soil should be kept moist.

Shoots generally appear in 25 to 40 days and should be watered after 50 days with 1 per cent. solution of ammonium sulphate.

After four to six months the young plants may be split up and planted out, reaching maturity 18 to 21 months later.

The use of longitudinal slices has not met with any success in Malaya, similarly disc slices less than $\frac{1}{2}$ in. thick have failed to produce new plants. Rooting hormones appear to cause no increase in establishment period nor show an increase in 'takes'.

(2) *Crown, Slip and Sucker Segments.*

This method consists in splitting the crown etc. vertically into a number of segments, the number depending on the size of the material. A normal-sized crown will give eight segments. The segments are pushed into sand, peat or soil to a depth of about an inch and kept shaded and moist. Small shoots appear within 20 to 30 days and the young plants are fit to be planted out in three to four months.

(3) *Other Methods.*

By cutting off the main stem and suckers, the plant may be stimulated to produce a large number of basal shoots, each of which may be detached when large enough and planted out separately.

Single crown leaves have been reported as being able to produce a new plant, but this method has met with no success in Malaya.

The use of certain hormones will encourage the production of basal slips and suckers at the expense of the fruit.

Summary.

1. The origin and history of pineapple cultivation in Malaya is discussed.

2. Malayan varieties are described in detail and the methods by which improvement in the crop can be effected are assessed.

3. The immediate and simple ways of obtaining better types of plants and the common types of defects are also described.

4. Methods for obtaining a rapid increase of planting material from desirable types are given.

NOTES ON CURRENT INVESTIGATIONS, JULY TO SEPTEMBER, 1953.

Compiled by the Chief Research Officer and the Acting Senior Agronomist.

Padi.

Results of the 1952-1953 Season Wet Padi Manurial and Cultural Trials.

Statistical analyses of results of the 1952-53 season's experiments have been completed. The majority of the trials are scheduled to continue for one further season and final conclusions cannot, therefore, be drawn from the results. Provisional indications are described in a succeeding paragraph.

The programme comprised some 220 experiments. Over 200 of these were devoted to the solution of manurial problems; a small number was concerned with cultural matters. The trials were numerically divided almost equally between smallholders' lands and Department of Agriculture stations; the former sites were used, with the co-operation of the owners, for the simple exploratory and demonstrational types of experiment, while the latter were devoted to the more complex developmental investigations. Experiments were carried out in all States and Settlements of the Federation but the largest numbers were in the Kedah-Province Wellesley region, the north-eastern and the North Perak regions.

Investigations were broadly concerned with the following matters:-

- (a) The evaluation of various commercial forms of phosphate, of various types and amounts of phosphate applied at different stages in the plant's development and of phosphate combined with nitrogen as compared with the two nutrients applied in separate forms.
- (b) The evaluation of sulphate of ammonia and nitrate of soda as sources of nitrogen and of their efficiencies when applied (i) on the mud surface and (ii) some three inches below that surface.
- (c) The discovery of suitable times for applications of nitrogen.
- (d) The evaluation of responses to a wide range of major and minor elements and of effects of applying nutrients in the sulphate form.
- (e) The effects of nursery manuring and the responses of different varieties to manuring.
- (f) Manurial requirements of padi in certain special areas (deficiency areas in the north east, peat areas in South Perak and *gelam* soil areas in Malacca).
- (g) Depth of ploughing, times of ploughing, broadcasting and off-season cropping.

The most solid advances resulting from the programme have been made in the Kedah-Province Wellesley and north eastern regions. Results

of experiments in North Perak are still inconsistent and much too indefinite to form a basis for even tentative recommendations concerning the manuring of padi. In the former regions the provisional indications are, broadly, as follows:—

- (a) That yield increases of the order of 2 to 3 cwts. of grain per acre may be obtained in many parts of the Kedah-Province Wellesley region by the application of phosphatic manures, supplying 100 lbs. P_2O_5 per acre, just before transplanting and the application of sulphate of ammonia, supplying 30 lbs. nitrogen per acre, some eight weeks after transplanting.
- (b) That only small differences in effects are to be expected between applications of most of the normal commercial sources of phosphate to the padi fields just before transplanting.
- (c) That very small applications of highly concentrated and soluble phosphates to nurseries may have comparable effects with very much larger field dressings of more normal phosphates.
- (d) That, in the north-west, there is little, if any, advantage in applying nitrogen and phosphate in a combined form over their application in separate fertilisers.
- (e) That sulphate of ammonia is a more effective form of nitrogenous fertiliser than nitrate of soda, and that there is little if any difference in effect between application to the mud surface and application some three inches below that surface.
- (f) Very tentatively, that nitrogenous dressings are better split between planting and some four to eight weeks later than when applied all at one time.
- (g) That, in the northern areas, there are definite responses to nitrogen and phosphorus but not to calcium and magnesium. There are indications, however, that the latter two, together with boron and manganese, may be essential in certain of the special deficiency areas in Kelantan and Trengganu.
- (h) That nursery manuring may well be effective in increasing yields; that certain varieties (e.g. Mayang Ebos 80 at Telok Chengai in Kedah) respond to manuring more than do others; and that the application of sulphate as calcium sulphate at 3 cwts. per acre has no adverse effect on padi.
- (i) That broadcasting of seed does not result in any depression of yields, as compared with those from crops grown by transplanting methods.

The 1953-1954 Programme of Manurial Experiments.

This programme is similar to that of the previous season, the main addition being a trial designed to test various methods of applying nitrogenous manures after transplanting. Progress in implementation

of the programme has been as follows:—transplanting took place in Kedah in July, nurseries were sown in July and August in most areas except Selangor and Trengganu; preparations for the experiments were made in the former State and cultivations were well advanced in the latter.

Dry Padi Manurial Trials.

Planting of the majority of trials in Kelantan was completed in July. Growth has been generally satisfactory.

Variety Trials.

Sowing of all trials for the 1953-54 season (with the exception of one trial in Selangor) was completed by the end of September and the majority of trials have been transplanted.

New trials laid down this season are either trials of new selections or trials with inter-State distribution of existing varieties/selections.

Variety Selection.

Analysis of selection work has been completed and the position for the 1953-54 season is:—

<u>Variety</u>	<u>No. of Lines</u>	<u>Stations</u>
Serendah Kuning	50	Kendong, Ampang Tinggi and Ulu Klawang, Negri Sembilan.
Nachin	42	Pulau Gadong, Malacca.
Siam	40	Pulau Gadong, Malacca.
Mayang Sa Batil	40	Genting, Penang.
Seraup	45	Titi Serong, Perak.
Radin Ebos	50	Telok Chengai, Kedah.
Anak Naga	267	Kota Bharu, Kelantan.
Mayang Sa Gumpal	1,000	Jelawat, Kelantan.
Seri Raja	1,000	Talang, Perak.
Seri Raja	1,000	Simpang Tiga, Perak.
Kontor	1,000	Bukit Merah, Province Wellesley.
Serendah Puteh	F.S.*	Kendong, Ampang Tinggi and Ulu Klawang.
Machang	F.S.	Titi Serong.
Acheh Puteh	96	Sungei Burong, Selangor.
Acheh Puteh	42	Panchang Bedena, Selangor.

Selection plots of Acheh Puteh in Selangor were the only ones affected by pests.

Mayang Sa Batil and Radin Ebos selections have been laid down in variety trials in Penang and Province Wellesley (Krian) and Perlis.

Hybridisation.

All hybrid seed has been sown and much transplanted. Cases of ultra-short maturation periods (50 days) have already been reported from Telok Chengai, Kedah.

* Foundation Stock.

Extension Trials.

Results from last season's trials in South Krian (Seri Raja) and Malacca (Reyong 6 and Serendah Kuning) have been analysed and are reported in the article on page 218.

Trials this year include:—

- (1) Seri Raja in Central and South Perak.
- (2) Mayang Sa Batil 8, Seri Raja and Pahit in Sungei Manik and the riverine districts of Perak.
- (3) Radin China 17 in West Pahang.
- (4) Serendah Kuning selections Nos. 3, 11 and 23 in Negri Sembilan.

Padi in Sand Culture.

Padi is being grown in pure acid-washed sand to which fresh nutrient solution is added every day. The treatments, in a factorial design, comprise three levels of N, P and K in all combinations. Plants grown without phosphate or nitrogen show characteristic symptoms of stunting and poor growth but so far no symptoms of potash deficiency can be detected in the pots with no added potassium.

Disease Control.

In a preliminary survey during September of the main padi-growing areas of Kedah, Perak, Province Wellesley, Negri Sembilan and Malacca, about 100 padi nurseries were examined. Approximately 25 per cent. of these nurseries were found severely infected by leaf spotting organisms, mainly *Helminthosporium oryzae*, *Nigrospora* sp., *Piricularia oryzae* and *Curvularia* sp. Two nurseries were found rather heavily infected by *Rhizoctonia solani*, approximately 55 per cent. carried from a trace to light infections of various leaf spots, while the remaining 18 per cent. of the nurseries were relatively free from any conspicuous disease. Altogether, 54 specimens of infected padi seedlings were brought to the laboratory for the isolation of the causal organisms, and their study is now in progress.

Pest Control.

In the attempt at biological control of stem-borers, no recoveries of the introduced parasite *Paratheresia claripalpis* v.d. Wulp have been made to date.

Cacao.

Progress has been normal during the quarter. Falling jungle trees, uprooted during storms, caused serious damage to some 70 to 80 Amelonado plants at the Federal Experiment Station, Jerangau. Growth of cacao at the Federal Experiment Station, Serdang, continued to be generally satisfactory; the first pods have been harvested from Field 49 (West African Trinitario), and the Upper Amazon and Herrania seed-

lings, field planted in October, 1952, were flowering in September, 1953. The cacao propagator was re-opened in September and cuttings of certain selected Trinitario seedlings are being rooted. A second consignment of cuttings of I.C.S. clones was received from Kew in September. Not more than 20 per cent. are expected to survive. The reason for the heavy casualties is thought to be the very low humidities recorded whilst passing through the Red Sea.

The more outstanding matters in reports of experiments on various estates and Department Stations are as follows: Amelonado plants maintained their superiority over selected and unselected Trinitario types in a Penang trial, in spite of drought conditions in July; cacao under rubber in tapping on a Negri Sembilan estate is reported to be extremely poor (the causes are suspected to be very dense overhead shade and severe root competition); cacao in a mixed cacao and durian trial at Selama Agricultural Station, Perak, is growing very satisfactorily; and a small number of cacao plants have been well established under coconuts on an estate in Perak.

Disease Control.

A stem canker associated with a species of *Nectria* has occurred fairly frequently at Serdang; the disease usually, if not always, appears after borer attack has been treated with orthodichlorobenzene and the bark has been damaged by the chemical. Cultures of the *Nectria* (which produces a *Fusarium* stage in culture) were inoculated on to young, healthy cacao plants but so far the disease has not been reproduced.

The fungus *Botryodiplodia theobromae* is frequently found growing on the dead and dying parts of plants suffering from die-back. Inoculations of cultures of this fungus on to healthy cacao plants did not result in invasion by the fungus. This strengthens the view that *Botryodiplodia* is not a vigorous parasite and is not able to attack healthy plants.

Symptoms similar to those reported from West Africa as "Sickle Leaf" were observed on one tree at Serdang. Affected leaves are narrow and twisted to one side, and in addition there is a chlorotic pattern on the lamina. These symptoms are, in West Africa, attributed to zinc deficiency.

White root disease (*Fomes lignosus*) has occurred in Trengganu; and a few isolated casualties have been caused by attacks of Red Root Disease at Serdang.

Pest Control.

Mites were reported on some seedlings on an estate in Trengganu, but the species is almost certainly predatory. Considerable trouble was experienced from ants eating out seeds before they germinated. These ants were not the usual seed-eating species. It is reported that BHC gives a fair degree of control.

Oil Palm.

Progeny Trials.

The progeny trial at Federal Experiment Station, Jerangau, (Bot. 0.8) is well established and the palms are in excellent condition. An estate block of backcrossed progenies (Bot. 0.4, planted March, 1951) is just starting to produce fruit bunches and is in excellent condition. Harvesting will not start for a year or so. The 'Dumpy' progeny trials on the same estate (Bot. 0.7 and Bot. 0.16) are at last beginning to recover from their poor start and in fact there are few deaths but a fair number of backward plants. Reports from estate managers indicate that the other field trials are in a satisfactory condition, except on one estate where there is considerable yellowing which it is hoped to rectify by an application of fertilisers.

Breeding.

Various consignments of pollen and seed have been despatched overseas and pollen and seed has been received in exchange.

Plans for the autumn planting of seedlings of Deli x Pisifera crosses at the Federal Experiment Station, Jerangau, are being prepared.

The viability of pollen used for controlled pollinations is now tested immediately prior to use as a matter of routine. It is hoped by this means to reduce the number of unsuccessful pollinations.

Manurial and Time of Felling Trials.

Manurial treatments, applied in a trial designed to test their effects on the extent of leaf bronzing at Serdang, have not had any apparent effect on this condition. Replanted palms, in the Serdang trial designed to test the effects of manuring and of time of felling old palms, have improved somewhat after ring cultivation. Those in the plots from which old palms were eradicated first are markedly better grown than others.

Coconut.

Growth in the varietal trial at the Federal Experiment Station, Serdang, was moderate only. A manurial programme is to be started in an attempt to improve matters. The recording of pre-treatment yields was started in a simple manurial trial on poor coastal soil on Trengganu smallholdings.

Pest Control.

An outbreak of the caterpillar of *Chalcoscelis albiguttata* (Snellen) [Limaecodidae] was reported in the Banting area of Selangor at the end of June, but the caterpillars were found to be attacked by a disease, almost certainly a virus, which kills them.

Fibres.

Ramie.

One crop was harvested from the clonal trial (Bot. R.1) at the College of Agriculture, Serdang, on the 18th August. Whilst the yields of fibre from the best clones have been very satisfactory, estimated costs of harvesting and extracting the fibre are very high.

Ramie grew and yielded well in a trial at Temerloh.

Manila Hemp.

Growth in a demonstration plot of Manila hemp at Sungei Ruan in Pahang was good. A varietal trial of the same crop was successfully established at Degong Agricultural Station in Perak.

In the experiment on control of *Marasmius* stem rot of Manila hemp, numerous fructifications of the fungus appeared on affected stems during the wet weather in September. As was to be expected, the number of fructifications was less on stems from which the outer diseased leaf sheaths had been stripped than on the unstripped stems. Spraying with a copper fungicide appeared, if anything, to have increased the number of stems on which fructifications were present.

Mauritius Hemp.

A trial to test the growth and yields of Mauritius hemp under various shades, including that of rubber, was established at the Federal Experiment Station, Serdang.

Jute.

Reports by the Colonial Products Advisory Bureau on a sample of jute harvested from a Selangor trial were favourable; suggestions for improvement are being tested in further trials.

Flax.

An observation plot of New Zealand flax grew satisfactorily during the period under review at Cameron Highlands Experiment Station.

Tea.

Soil Erosion.

In an observation at the Federal Experiment Station, Cameron Highlands, *Eupatorium riparium* and *Dolichos hosei* are proving satisfactory in attempts to discover plants useful for checking erosion. *Indigofera endecaphylla* is less suitable because of its tendency to climb the tea bushes.

Rooting Trials.

Rooting trials are still in progress at Cameron Highlands.

Disease Control.

In investigation of blister blight disease (*Exobasidium vexans*), samples of plucked leaf from each plucking in two fields at the Federal Experiment Station, Cameron Highlands, have been examined throughout the quarter. From this examination information on the severity of the disease at different times of the year is being obtained. During the months of July, August and September the disease remained at a low level.

The possibility of using copper fungicides in the form of dusts instead of sprays is being investigated, the benefit of dusts being the reduction in labour costs resulting from the increased speed of application as compared with spraying. The first experiment, carried out on tea recovering from pruning, was concluded in July. Results were promising, good control being obtained, and two further experiments have been laid down to test the efficiency of dusts in the more severe conditions to be expected at the end of the year.

An experiment to compare the efficiency against blister blight of 11 fungicides has been commenced.

Pineapple.

Experiments at the Federal Experiment Stations, Jalan Kebun and Alor Bukit, in Selangor and Johore respectively, are progressing well. The benefits of potassic manuring and of copper solution sprays continue to be demonstrated.

Selection.

The clonal and mass selection plots at Jalan Kebun, Selangor, have been regularly visited and recordings taken of vegetative characters of all clones.

Twenty-five South African Smooth Cayenne plants were released from the quarantine station at Pulau Tekong Besar, Singapore, in July, and these have been planted in an observation plot at Jalan Kebun.

Disease Control.

Visits have been made during the quarter to Jalan Kebun with the object of discovering as soon as possible any disease which may appear there. So far no serious disease has been observed; leaf spots have been found to be associated with various fungi, including *Asterinella stuhlmanni* and *Curvularia* sp.

Pest Control.

Sarawak pines growing in pots were inoculated with the mealy-bug *Dysmicoccus brevipes* (Ckll.) on the 3rd September. Six plants were kept as controls and were isolated from ants and free from mealy-bugs; the six inoculated plants were not isolated from ants.

The inoculations have been satisfactory and the mealy-bugs have more than doubled in number. No wilt symptoms have developed but green spotting of the leaves has occurred.

Pasture and Fodder.

Fodder Grass Manurial Trials.

The results of a series of fodder grass trials at the Federal Experiment Station, Serdang, have been critically examined. They reveal that nitrogen and potash are the main nutrient requirements at Serdang; that artificials and farm yard manure have a complementary effect on growth and yields; that uniformity of the yielding pattern is greatest when manures are applied most frequently; and that yields of 30 tons fresh guinea grass per acre per year can readily be obtained by manuring, even on poor soils. They further suggest that, with heavier nitrogen dressings, applied at or about the same times as, and with the same frequency as cuttings, yields could be further substantially increased.

Fodder Grass Analyses.

Some 229 samples from four fodder grass experiments at the Federal Experiment Station, Serdang, were analysed during the quarter. In Expt. 25 (*Axonopus* species and shade) there has been little difference in yield between the two species or between shaded and unshaded plots. Shade appears to have little effect on percentage of protein but *Axonopus compressus* shows a slightly higher protein content than *Axonopus affinis*. The percentage of carbohydrate shows a higher value in the unshaded plots.

Pasture.

Growth and yields in a shaded pasture manurial trial at Serdang were exceptionally good.

Vegetables and Food Crops.

Maize.

Results of a maize variety trial at Serdang have given the preliminary indication that certain imported Australian hybrids are very greatly superior in yielding capacity to local types.

Soya Bean.

The selection plots of the seven bulked Java strains have been harvested and results are being examined.

Groundnut.

A total of 318 rows of single plant selections has been harvested at Serdang and results are in the course of analysis.

Fertilisers.

A crop of beans was harvested from the trial, at Cameron Highlands Experiment Station, designed to test various alternative mixed organic and inorganic manurial systems in an attempt to find practicable alternatives to the traditional prawn dust system. The treatments involve prawn dust, Sterameal Black Label and a groundnut-soya bean cake mixture, applied to cabbages, followed by beet and beans manured with artificials. The beans in plots manured with the Sterameal and with the bean cake mixture grew better than did those in plots manured with prawn dust.

Disease Control.

Investigations on control of diseases of vegetables are in progress as follows:—

Tomatoes. Blight (*Phytophthora infestans*).

Potatoes. Bacterial wilt (*Xanthomonas solanacearum*).

Carrots. Leaf blight (*Alternaria dauci*).

French beans. Anthracnose (*Colletotrichum lindemuthianum*).

Arrowhead. Leaf spotting (*Ramularia sagittariae*).

Chinese mustard. Leaf rot (*Rhizoctonia solani*).

Pest Control.

Onions. Trials with insecticides against the introduced onion fly gave yields about 25 per cent. greater in the treatments than in the controls, but of the insecticides used only dispersible BHC can be considered safe on account of the short maturation period of onions in Malaya.

Cloves. A further field trial for the control of the two Cerambycid borers of cloves has been carried out. Dieldrin and Gammalin treatments showed no attack, but full protection was not given by BHC dispersible powder. All control trees were attacked.

Pepper. Two species of weevil, *Lophobaris piperis* Mshl. and *L.serratipes* Mshl. have recently been reported damaging pepper in Selangor and in Singapore. *L.piperis* is the more common. Damage can be serious and complete die-back of the vines can be caused. The eggs are laid singly in the nodes, the female gnawing a hole for this purpose. The young larva first rings the node, thus causing die-back of the vine beyond this point, and then bores downwards in the centre of the stem below the attacked nodes and causing this also to die.

This weevil has not previously been reported from Malaya though it is known from Java, Sumatra, Banka and Borneo.

Fruit.

Pisang serendah were planted in a banana manurial trial at the Federal Experiment Station, Cameron Highlands. In a similar trial in Negri Sembilan, *pisang mas* suckers were substituted for *pisang embun*

which had suffered severely from Panama Disease. Pomeloes are said to be growing satisfactorily in an observation plot on slimed land in the Kinta area of Perak.

Livestock.

Goats.

Twenty-seven cross-bred kids were born during the quarter at the Federal Experiment Station, Serdang. A rare disease—diagnosed by the Veterinary Department as *Melioidosis*—attacked the flock at Serdang and caused 14 casualties. Performance records of all imported breeds and of their pure and cross-bred progenies have recently been critically examined. It is clear that the imported breeds are generally far superior in milk production and in growth rates to the local goats, but that they are considerably inferior in hardiness and prolificacy. The Saanan, British Alpine and Anglo-Nubian are regarded as being generally satisfactory for Malaya. The Toggenburg is considered to be unsuitable. The first cross between the satisfactory imported breeds and local animals appears to be an overall improvement over local types; its production performances are superior and its hardiness and vigour are almost equal. The low prolificacy and delicacy of the imported breeds has resulted in a slow rate of production of pure-bred males for crossing purposes. Methods of overcoming this difficulty are being investigated.

Poultry.

Trials to test an antibiotic feed supplement with rations based on (a) animal protein and (b) vegetable protein were initiated in several areas.

Soil Investigations.

Soil Surveys.

With the arrival of a Geologist trained in soil survey, a soil survey of the Federal Experiment Station, Serdang, was carried out and the terminology originally suggested by Owen was applied to the soil series found at Serdang. Eight series were identified and some of these seem to be peculiar to Serdang. The greater part of the upland soil was identified as belonging to the Kedah series but opportunity was taken to split this up, the shallower soils near the hill tops, where cacao and oil palms do not grow very well, being continued as the Kedah series, while the low-lying, deep friable brown loam was tentatively named the Serdang loam.

Agricultural and Padi Test Stations.

Ninety soil samples from two Padi Test Stations in Negri Sembilan were received. These were taken as a part of a plan to do detailed soil analyses of all Padi Test Stations and to study the variation of the soil

over the entire Station. So far only mechanical analyses and pH determinations have been carried out on the samples.

Gelam Soils.

Field Survey. The soil profiles in several large areas of *gelam* in Trengganu were examined as part of the project to relate *gelam* vegetation to different soil conditions. In Trengganu, *gelam* was found to have established itself on two main types of deposit, viz.

- (a) Coarse, well leached sand showing varying degrees of podsolisation. *Gelam* stands on such soils were found in low-lying ground near the coast, separated from the sea by raised beaches (e.g. north of Dungun).
- (b) Peat often more than 9 ft. in depth and apparently very acid as judged by the presence of much undecomposed organic material (e.g. in Batu Rakit drainage area).

Only in limited areas was *gelam* found to occupy heavy clay soils comparable with those found in Malacca. Corresponding to each of the above types of 'soil' there existed easily distinguishable types of *gelam* stands thus:—

- (a) On the leached sand profiles the stands had the appearance of 'park-land'. The individual trees, though often tall, were very crooked and the foliage generally was sparse and often yellowed. There was a general absence of young *gelam*, which can be attributed to the frequent fires which occur in such areas, as evidenced by the charring of old trees often to a height of more than 20 ft. Fairly luxurious growth and regeneration occurred whenever permanent surface water or a high water table existed. Under such conditions the profiles under *gelam*, though sandy, generally contained a higher percentage of clay. In one area, where leaching of the sand was so extreme that all signs of podsolisation had vanished and the profile consisted entirely of white sand, a stand of old 'park-land' *gelam* was obviously dying out. Thus though *gelam* appears to be able to exist in conditions of extreme soil poverty, soils exist which will not supply even minimum requirements of plant nutrients.
- (b) On peat the *gelam* appeared to make vigorous growth. The trees were tall and straight and the foliage dark-green and profuse. Growth of young 'cane' was very dense. In appearance these stands were very similar to the stands of *gelam* found on heavy clay in Malacca. The associated vegetation consisted of the same species as those found in the Malacca *gelam* stands. The shallow-rooting habit of the *gelam* (found by uprooting several *gelam* trees of various sizes) and the great depth of the peat in many places seems to obviate the possibility that the *gelam* feeds on the clay underlying the peat rather than on the peat itself.

Chemical analyses including determinations of total sulphur, water soluble sulphates, 'free' iron, exchangeable manganese and exchangeable bases have been carried out on a considerable number of *gelam* soils. The total sulphur in some of these *gelam* soils has been found on occasion to be as much as 6 per cent., and the amount of water soluble sulphate formed on air-drying sometimes exceeds 2 per cent. The exchangeable manganese increases with increasing depth down the profile. One of the most interesting facts emerging from the chemical analyses of these soils is the very low content of exchangeable cations in the upper horizons, and it is suggested that the very strong acidity developed in some of these soils has assisted in the removal of exchangeable bases.

To-date the work on *gelam* soils has shown that they vary very considerably as regards texture, being anything from heavy clays to sand to peat. Chemically they seem to generally develop a high sulphate content on drying and to be low in exchangeable bases.

Laboratory Work.

A micro-method using a distillation technique for determining the base-exchange capacity of clays is being tried out and has been found to work successfully. Clays from the heavy coastal clay, from granite soils and from inland alluvium have been separated and their base-exchange capacity determined. This has been shown to vary from about 11 m.e. for clay from granite soils to 34 m.e. for clays from the heavy coastal clays.

Miscellaneous Pests.

Patanga succincta (L).

An outbreak of this large, swarming grasshopper was reported from Sungei Ruan, Pahang, in the middle of August. It would seem that a swarm settled on newly cleared land planted with vegetables and dry padi about six weeks earlier, but no report was made. A visit was paid to the area and it was found that the insects had dispersed over practically the whole of the 2,000 odd acres of cultivation in this area. They were concentrated in the moist valleys where they were probably laying eggs.

This grasshopper was also found to be present in Ulu Gali, only a mile or two from Sungei Ruan, although the Malay cultivators said that it was not there. This would seem to be due to lack of interest rather than ignorance, because they had suffered an outbreak during the previous season.

Termites.

Experiments in the destruction of termite nests have been carried out and it was found that the proprietary preparation Aldrex 2 diluted with water to give 0.04 per cent. active ingredient gave very promising results, 500 c.c. poured into a nest through a hole bored into the nest

centre giving complete kill in two large nests. Dieldrex 15 diluted to give 0.036 per cent. active ingredient and applied in the same way was also promising, but appeared to be slower in action. Other insecticides tested were not satisfactory.

MECHANISATION

Half-yearly Report, April to September, 1953.

Compiled by the Agricultural Engineer.

Recent Importations.

The following new machinery has been received:—

McConnel Jay Windrower
Massey Harris "80" Rice Special Combine
Opperman Baler
Howard Trailing Rotavator
Cruikshank 2-furrow Mouldboard Plough
Alley 3-way Tipper Trailer
Alley Low-loading Trailer.

Tests and Modifications.

Harvesting Machinery.

The Massey Harris combine, the McConnel Jay windrower and the Opperman baler will be tested during the 1953-54 harvest season which starts in December. A number of new machines designed by the Department together with modified commercial machines will also be tested, and full reports will be published in this Journal.

Howard Trailing Rotavator.

This machine, which is suitable for use with the new-type Fordson Major tractor, was received towards the end of the period under review and tests on padi land have not yet been carried out. On mineral soils at Serdang the machine, which is fitted with a hydraulic lifting cylinder, worked very well, even after heavy rain.

Cruikshank 2-furrow Mouldboard Plough.

This plough, which is intended for use with the new-type Fordson Major tractor, was received in September and has been given preliminary tests. It performs satisfactorily, but its most interesting feature is that it is fitted with bar points in place of the more usual share, and its value cannot be evaluated until it has been in use for a long period.

Alley Trailers.

Two types of Alley trailers have been received, the low-loader and the three-way tipper.

One low-loader has been in routine use at the Federal Experiment Station, Serdang, mainly behind the old-type Fordson Major tractors, and has proved very satisfactory. The low height of the trailer body and the ease with which the side boards can be removed makes it very suitable for carrying heavy objects, but it tends to be rather wide for the average laterite road in Malaya.

Two of the three-way tippers have also been in routine use. The three-way tipping device, which is coupled to the hydraulic lift of a Ferguson or Fordson tractor, is extremely useful where laterite is to be carted from a pit and dumped at the roadside. The chassis of one of these tippers has become seriously bent in use but it must be borne in mind that they have been loaded with an "Overloader", mounted on a D4 tractor, which drops a cubic yard of laterite into the trailer from a height of about five feet.

Tractor-mounted Threshing Drum.

The simple tractor-mounted threshing drum described in the last Half-yearly Mechanisation Report, in the April issue of the Journal, has been further developed. The old drum, which was 24 ins. in width, has been replaced with one twice as wide in order that two operators can work side by side simultaneously. Padi from the drum is now cleaned on an oscillating sieve before falling into baskets placed beneath the machine. These improvements have greatly increased the efficiency of the machine, since nearly twice the output can be achieved without markedly increasing the depreciation and fuel charges. The addition of the sieve has, of course, reduced the trash in the threshed padi, although winnowing is still necessary.

The tractor-mounted drum was tested during the harvesting of off-season crops at Bukit Merah in Province Wellesley. The tests were designed to determine:

- (a) the maximum output of the machine,
- (b) the maximum output per man hour, and
- (c) to compare the output per man with that obtained by conventional methods of threshing in a *tong*.

The outputs obtained in these tests are summarized in Table I.

Table I.
Output of Clean Padi from TM Threshing Drum.

Trial.	Number of Men.	Organisation.	Total Output per Hour. Lbs. of Clean Padi.	Output per Man Hour. Lbs. of Clean Padi.
A	4	2 men collecting padi and placing near machine 2 men feeding	445.0	111.3
B	6	2 men collecting 2 men handing to feeders 2 men feeding	666.6	111.1
C	3	All men collecting and feeding individually.	426.6	142.2
D	2	Both men feeding from a previously prepared stack.	352.0	176.0
Hand Threshing	2	Hand threshing in tong.	157.2	78.6

From this table it will be seen that the maximum output of the machine was 666.6 lbs. per hour, obtained when six labourers were employed, and the maximum output per man hour was 176 lbs., obtained when two labourers were feeding the machine from a previously prepared stack of padi. By comparison, two labourers threshing by *tong* achieved a total output of 157.2 lbs., or 78.6 lbs. per man hour.

In Table II the output of the tractor-mounted drum is compared with those of similar machines previously tested, and described by Allen and Haynes in an article in the April, 1953, issue of the Journal.

Table II.

Comparison of TM Drum with Other Methods of Threshing.

Site.	Method.	Output per Man Hour.
Bukit Merah	TM. Drum (Maximum)	176
Kelantan	Power Driven Drum (Maximum)	64
Perak	Robinson Midget Thresher	558
Bukit Merah	Hand Threshing in Tong	79
Kelantan	Hand Threshing in Tong	75
Perak	Taki Foot-treadle Thresher	67

Investigations into the Cultivation of Wet Padi.

Large Diameter Steel Wheels for Padi Cultivation.

The development of large diameter, steel wheels for cultivation of padi soils where a pan exists within a reasonable distance of the surface has been previously mentioned (*Malayan Agric. J.*, **36**, 63.). Two Ferguson tractors fitted with these wheels recently ploughed an area in Negri Sembilan where tractors with standard wheels, rubber tyres with girdles or oversized rubber tyres could not work at all.

The whole area of 42½ acres was ploughed, the small lateral bunds being ploughed through (with the owners' consent), only the bigger transverse bunds, which were roughly on the contour, being left. The area was subsequently disc-harrowed but conditions were difficult, being neither dry nor thoroughly wet, and a small area of about ½ acre could not be worked. The general feeling among the owners of the land was that the cultivation was successful and they were quite prepared to rebuild the lateral bunds.

The tractors were, as was to be expected, bogged on a few occasions but no damage was sustained and, after the brake drums had been stripped and thoroughly cleaned, they were put on to other work.

The rates of working and fuel consumption are given in Table III.

Table III.

Ploughing and Disc Harrowing of Padi Sawah at Tarachi, N. Sembilan.
Ferguson Tractors with Large Diameter Steel Wheels.

Total area ploughed	42.5 acres
Total time ploughing	176.0 hours
Hours per acre	4.1 hours
Total area disc harrowed	42.0 acres
Total time harrowing	196.25 hours
Hours per acre	4.8 hours
Total fuel used	283 gallons
Total oil used.	75 pints
Cost per acre including depreciation and maintenance	
{ ploughing	\$17.70
{ harrowing	\$18.85

Bombardier Half-Track and Wheel Strakes for Padi Cultivation.

Bombardier half-track conversions for the Ferguson tractor (described in the last half-yearly Report) have proved invaluable in Perak on soils which do not dry out more than a foot below ground level.

In a costing trial at Bruas, the following costs were obtained:—

<i>With Half Tracks</i> —2F mouldboard plough	\$32.80 per acre
Rome disc-harrow (2 runs)	15.55 „ „
<i>With Wheel Strakes</i> —1F mouldboard plough	64.00 „ „

These costs cannot be directly compared with those given in Table III because the sites and weather conditions differed widely.

Ferguson Tractors on Peat Soils.

Ferguson tractors have been used at Chenderong Balai in Perak, where most of the Department's experimental work with modified track-laying tractors was carried out. Most encouraging results were obtained with the Bombardier half-tracks, the Roto Plough (both described in the last Report), the new Ferguson off-set harrow, and a modified Krause 7 harrow-plough. The last-named implement was fitted with cutaway discs and an extra coulter to absorb the side draught.

Investigations into the Cultivation of Dry Land Crops.

Mechanical Cultivation of Coconuts.

Interesting results have been obtained from depth of cultivation experiments on a coconut estate in Selangor. This trial was laid down

in early 1950 to compare ploughing, harrowing and hand-slashing. There has been no reduction in yield of nuts due to mechanisation, and as costs for harrowing have been \$1.70 to \$2 per acre, as compared with \$5 for slashing by hand, mechanisation is considered to have been worthwhile. Very considerable differences have been noted in the flora of the plots, ferns predominating on the hand-slashed, and grass on the harrowed plots.

NOTES ON EXTENSION WORK, JULY TO SEPTEMBER, 1953.

Compiled by the Acting Chief Field Officer.

Padi.

Reports of the off-season wet padi crop from Kedah, Kelantan, and Province Wellesley were satisfactory both as regards acreage and yield. Estimates placed the former at 7,340 acres and the latter at 2,000,000 gantangs compared with 4,230 acres and 1,125,000 gantangs respectively last season.

Of the inaugural large scale demonstration of off-season padi cultivation staged at the Salor Irrigation Area, Kelantan, mentioned briefly in the previous report, the State Agricultural Officer, Kelantan, had this to say:

“The off-season padi cropping trial in the Salor Irrigation Area came to a close at harvest time in August, and it left no doubt that double-cropping was feasible in such an area. Yields were satisfactory having regard to the complete neglect of holdings after the completion of transplanting, on which batases were not even made up, and to the fact that many padi planters applied little, if any, of the manure issued to them for the purpose and hoarded it for the main padi crop later in the year. A special effort was made to bring visitors to the area at the time the padi matured, particularly padi planters from other areas where there was a chance of double-cropping, and also Hon’ble Members of State Council. In all, about 450 persons were brought to see the crop and form their own conclusions.”

Off-season cropping with crops other than padi is an agricultural feature annually in both Malacca and Selangor but, whereas in Malacca the usual 2,000 acres approximately were cultivated with lobak, lettuce, tomatoes, sweet potatoes, ginger and chillies, acreages in Selangor were less than normal, largely owing to emergency re-grouping of the farmers. Still, some 700 acres, mainly of maize and tobacco, were successfully cropped.

A dry spell early in August affected the main crop planting throughout Malaya, in varying degrees, but more severely in the East Coast States of Kelantan and Trengganu where conditions are now bordering on the critical. The drought, fortunately, was not prolonged in the West Coast States and any leeway was rapidly made up with the eventual onset of the rains. Nursery work, cultivation and transplanting were all reported to be proceeding smoothly and on schedule.

Inter-departmental co-operation between the technical departments concerned and the District Office, culminating in a concerted drive to encourage padi planting at Pahang Tua, has resulted in approximately

600 acres being planted this season as against none last season. The importance of the need to follow up this effort has not been overlooked and staff members of the technical departments in their weekly visits to the area spare no efforts to try and ensure a satisfactory crop in the hope that the planters will be stimulated to carry on in future seasons in this potentially highly productive area.

The Department's Padi Experiment Stations are working steadily to regain the position lost during the war in padi varietal and selection work and seed distribution. Malacca is the most advanced area, where 82 seed farms, under private ownership but sponsored by the Department of Agriculture, each of 1 acre, have been planted for the multiplication of selected seed of Nachin 11, Reyong 6 and Serendah Kuning 3. During the quarter a total of 11,276 gantangs of improved padi seed was distributed to padi planters. Arrangements have also been made for the Department of Agriculture to hold sizable stocks of medium and short-term seed padi in Selangor and Province Wellesley against possible emergency late in the season.

Extension is necessarily a corollary to fundamental and applied research and their mutual inter-dependence is well illustrated in the increased number of both variety and manurial field demonstration plots which have been planted during the current season, the former totalling 220 and the latter 250. The varieties demonstrated are Serendah Sungei Dua 25 in Kedah, and Serendah Kuning 3, 11 and 23 in Negri Sembilan, while the manures under demonstration in Kedah, Province Wellesley, Kelantan and Negri Sembilan are principally phosphate at planting followed by a dressing of ammonium sulphate six to eight weeks after transplanting.

While the widest possible publicity has been given to the extension campaign encouraging the use of manures for padi in both Kelantan and Kedah, the number of field officers who can be spared full time for this work is small and consequently coverage of the padi areas is imperfect. An expedient, adopted in Kelantan, has been to erect large numbers of signboards of distinctive shape and colour bearing the legend "Pakai Baja" (Use Manure) in as many manured fields as possible in the hope that they will still further draw public attention to the benefits resulting from the application of recommended manures to padi. To-date, 78 tons of the recommended manurial mixture have been sold in Kelantan as against 11½ tons at the same time last year. Encouraging though this is, the attainment of the target of 1,500 to 2,000 tons, having regard to the early onset of the monsoon and attendant distribution difficulties is now, unfortunately, verging almost on the impossible.

In Kedah, where communications are good, 80 tons of ammonium sulphate, 15 tons double super and 5 tons Christmas Island rock phosphate have been distributed up to the end of August as well as large quantities of bat guano. Shipping difficulties have curtailed the supplies of Christmas Island rock phosphate, and had it been freely available a much larger quantity would undoubtedly have been sold as the demand for it is brisk.

Sales of ammonium sulphate are expected to increase considerably during the next quarter as most of the top dressings will be due for application then.

Pest damage in the nursery and early stages of planting was conspicuous by its almost entire absence. Only one case was reported necessitating Departmental action to control an attack of Army Worms (*Spodoptera* spp.) over an area of 20 acres of young padi in Pahang.

Rubber.

Distribution of improved planting material during the quarter comprised 12,029 yards of budwood and 83,000 clonal seedlings. Smallholders generally are keen to use clonal seedlings but, it is interesting to note, one source in Pahang reported a definite swing in opinion amongst smallholders in that area from clonal seedlings in favour of budwood and quoted the alleged high price of clonal seedlings—15 cents each—and their not ready availability as the reasons.

Pending the onset of favourable planting weather large stocks of clonal seedlings of plantable size are being held at most Agricultural Stations on behalf of smallholders undertaking new or re-planting. This quarter, clonal rubber seed collection from certain approved sources was undertaken for the first time by the Department of Agriculture and valuable assistance was rendered by the Rubber Research Institute staff who have so far been responsible for collection in the whole of Selangor. During the quarter 4,129,610 seeds were collected and distributed with the assistance of the Rubber Research Institute to States and Settlements for planting in Agricultural Station nurseries, estate or *kampong* contract nurseries and assisted *kampong* nurseries.

The marketing of smallholders' latex, as latex, is encouraged and schemes for collection operate in most States. From 12 collection centres in Kedah, latex of 114,187 lbs. dry rubber content, valued at \$84,873 nett, was sold by smallholders to commercial interests. One new collection-cum-processing centre commenced operations at Tanjong Besar, Pahang, during the quarter while the activities of the co-operative factory at Ulu Langat, Selangor, were greatly expanded.

A leaflet entitled "You Cannot Eat Rubber" designed to wean the rubber smallholder away from his dependence upon rubber as a sole crop and to encourage the diversification of smallholding agriculture was printed (20,000 copies) and distributed by the State Agricultural Officer, Kedah, throughout Kedah and Perlis.

Fruit.

The distribution of fruit planting material from Department of Agriculture Stations, comprising largely rambutans and durians, totalled 5,880 budded plants and 390 miscellaneous seedling trees including 257 mangosteens. The output of seedling shade trees destined for housing schemes and new villages grossed, during the quarter, 10,400 plants,

Coconuts.

Copra production in Johore is exclusively a smallholding industry and ranks, as far as smallholders are concerned, second in importance to rubber. Within the limits of staff available, incidentally totally inadequate for effective coverage of the planted area which is estimated at 117,000 acres, some useful work was accomplished in controlling *Oryctes rhinoceros* and *Artona catoxantha* as well as in kiln construction and kilning. The industry, however, is greatly in need of guidance, particularly with regard to grading and marketing of the copra produced, for it is a well known bitter experience that quality copra seldom, if ever, receives a premium. Similar experience in the marketing of copra is reported from Perak where the Department of Agriculture has been actively encouraging copra production instead of the sale of nuts to middle men, as the former is, at present prices, a much more profitable undertaking.

New villages in Kedah received from the State Department of Agriculture 800 germinated coconut seedlings.

Coffee.

Interest in the planting of Liberian coffee on peat and muck soils in the coastal districts of Selangor was on the increase and it is estimated that half the areas approved under Scheme 2 of the Rubber Replanting Ordinance will be planted with coffee and not replanted with rubber. Requests by smallholders for 300 coffee seedling plants were met by the Department.

Pineapples.

It is reported from Johore that pre-planting treatment of pineapple slips with Bordeaux mixture or other copper compound based on Department of Agriculture recommendation, is being increasingly followed and is now almost standard practice. The main reason for the treatment is to prevent green die-back which is supposed to be due to copper deficiency. This supposition, however, requires further investigation.

Vegetables.

A small vegetable garden for seed production was maintained at Gajah Mati Agricultural Station, Kedah, and 107 ozs. of the smaller seeds were supplied free to visitors. Cuttings of improved types of sweet potatoes and tapioca were also made available.

Mechanical Cultivation.

Contract tractor work at smallholders' level is now accepted as the responsibility of the Rural and Industrial Development Authority. On occasion, Department of Agriculture tractors do assist and during the quarter cultivated 220 acres for foodcrops in the immediate vicinity of new villages, 67 acres for dry padi and 60 acres for wet padi.

Livestock.

Pigs.

Pure-bred Middle White stock distributed as weaners from Department of Agriculture farms comprised 80 boars and 42 gilts. Many "bookings" had still to be met. The improved state of the pig-keeping industry noted during the last few months has been due in no small measure to the concerted efforts made by the staff of the Department of Agriculture in all States, but particularly in Perak and Malacca. *Inter alia*, the Department has increased the number of its stud and breeding farms, arranged for one or more stud centres to be established in new villages, provided the services of pure-bred Middle White boars for private rearers and organised supplies and distribution of Chinese gilts to meet local shortages as it is the half-bred rather than the pure-bred Middle White or Chinese pig which is the most profitable to rear. A scheme, too, was started in Malacca, for which the sum of \$20,000 was voted, to encourage an expansion in the number of breeding sows in the Settlement's new villages.

Goats.

Study of the reactions of the imported British Alpine, Toggenburg and Saanan breeds to tropical conditions in Malaya has not progressed sufficiently far to permit introduction of an active expansion policy. Experience gained to date, however, where bucks are at stud in selected *kampongs*, gives a pointer to be noted in any subsequent extension programme. It has been revealed that local owners of herds, although exhibiting great interest in the new breeds, are reluctant to bring does for service preferring to have the stud bucks brought to them. In the event, therefore, it may pay to follow "flood" tactics with the new breeds in place of adopting the system of having a few scattered bucks at stud.

Poultry.

Interest in poultry farming was on the increase judged by the growing number of smallholders taking to poultry keeping on an organised scale and also by the demand for courses in poultry rearing. In the bigger, populous centres, such as Malacca and Penang, large commercial poultry farms cater for the public demands; in meeting requests from the public elsewhere the Department of Agriculture distributed 3,374 hatching eggs, 69 mature cockerels, 59 pullets and 2,784 chicks under three months old, all of pure-bred imported strains.

Fish.

Tilapia mossambica, introduced for the first time into Malaya from Java during the Japanese occupation of Malaya, has quickly become acclimatised to Malayan conditions and the ease with which it can be reared brings a valuable and easily obtainable source of animal protein

PLATE I.



On the right can be seen a 'model sty' built by the Department of Agriculture in Permatang Tinggi New Village, Province Wellesley. The superstructure on the left was built by the villagers.

PLATE II.



Half-bred Middle White x Chinese weaners at Kampong Pandan, Kuala Lumpur.

PLATE III.



The goat on the left is the 2½ years old *kampong* mother of the two 5 months old half-bred British Alpines she is running with. The 2½ years old British Alpine sire is in the background.

PLATE IV.



The 2½ years old *kampong* mother (on the right) with her 5 months half-bred British Alpine kid.

within the reach of most rural dwellers. Most States report an ever increasing interest in Tilapia-rearing and nearly all have had financial aid from votes administered by the Member for Agriculture & Forestry to undertake pilot schemes to foster Tilapia production. From one such scheme in Selangor, 590 fry were distributed as stock for nearby newly constructed ponds. It should be recorded, however, that the Fisheries Department is the main source of fry and requirements for sponsored schemes are always readily forthcoming on request.

New Villages.

Financial assistance to the order of \$116,400 was granted in the furtherance of agricultural schemes in new villages such as construction of piggeries, digging of experimental fish ponds, fencing, and improvements to drainage of vegetable and foodcrop areas. In no case were the full costs of a scheme given, since at least 50 per cent of self-help on the part of the villagers is expected and must be forthcoming before any allocation is made.

Agricultural Education.

Agricultural education was given priority attention during the quarter and much falls to be reported under this heading. The progress reported is detailed by States as a fuller appreciation is obtained of the scope of the work undertaken.

Kedah.

A three month's course on fruit and rubber propagation and poultry rearing was given at Gajah Mati Agricultural Station to two selected farmers. Each was accompanied by his family and accommodation and subsistence were provided. The scope of these courses is to be enlarged and application has been made to the Rural and Industrial Development Authority for funds to establish a training school capable of dealing with 10 trainees at one time and their families.

As part of the State-run Civics Courses, four Field Days were held at Gajah Mati Agricultural Station, and at two in which a referendum was taken the talk on agriculture and a visit to the Station topped the popularity poll.

Kelantan.

Organised trips were arranged to enable 450 farmers and others to witness off-season padi cropping at the Salor Irrigation Area.

Penang.

A scheme for training school boys in padi cultivation was approved and \$1,500 allocated by the Settlement Government for the purpose.

A proposal to propagate budded fruit at four school gardens with the object of giving instruction on budding technique to school boys has been accepted and instruction is about to commence.

A Field Day for village headmen was held at the Bukit Mertajam Agricultural Station, in the course of which demonstrations on fruit and rubber propagation were staged.

Local aspects of agriculture were demonstrated at Ayer Hitam Agricultural Station, Penang, to 500 school children and Scouts.

Perak.

A series of courses on vegetable growing, covering a period of two months, was held at Taiping, the attendance at which totalled 250. A similar series on poultry is planned.

At Degong Agricultural Station a course is at present in progress for 12 Malay trainees. Subjects taught are fruit culture, rubber management, poultry and cattle husbandry and mechanisation. Financial aid has been sought from the Rural and Industrial Development Authority in order that its scope may be broadened and larger numbers of trainees catered for. Conducted tours of this same Station were arranged for 16 Malay farmers and 50 school teachers.

Lectures on and demonstrations of fruit propagation were given for the benefit of 30 students of the Malay School, Tapah, and of 32 Ketuas from all over the State.

Members of the Women's Institute, Kinta, were given talks on vegetable gardening, poultry husbandry and fruit propagation.

Selangor.

Three courses in poultry and goat rearing were held at Cheras Agricultural Station where, in 1952, a Training School with hostel accommodation and lecture room facilities was built. In all, 28 students attended, some of whom came from other States.

Field Days on three occasions were held at Setapak and Sungei Buloh Agricultural Stations in connection with two Chinese and one Indian Civics Courses.

Pahang.

Two very successful one week courses were held at Dong for 25 students who were provided with accommodation in Dong Malay School. The curriculum included demonstration and practical work in poultry husbandry, rubber and fruit budding, visits to agricultural areas under development near Raub, talks of general interest by officers of other Departments with affinities close to agriculture and, on two nights each week, films, instructional and otherwise, were shown with the co-operation of the Department of Information.

For the benefit of 35 Kuala Lipis smallholders, a one day's practical budding course was held at the Agricultural Station. Similar courses were held for 56 people in Kuantan District but with emphasis on rubber. Fruit budding demonstrations were also held at Telok Sentang Malay School.

Negri Sembilan.

Funds have been provided by the Rural and Industrial Development Authority to erect quarters and lecture room facilities at the new Rembau Agricultural Station where it is proposed to hold agricultural training courses for selected farmers. The trainees will be permitted to have their families with them at the Station during the training period.

Malacca.

In connection with Settlement Civics Courses, three Field Days were held at Sungei Udang Agricultural Station and Pulau Gadong Stud Farm.

At the request of the Penghulu, Sungei Udang, the Settlement Agricultural Officer gave lectures to mukim padi planters on "Improvement of Padi Yields."

Johore.

On eight occasions, Field Days were staged at various Agricultural Stations for the benefit of those attending Civics Courses. Emphasis was placed on demonstrating the correct methods of establishment of fruit and rubber nurseries and budgrafting technique.

Pest Control.

A further outbreak of the "Bombay Locust", *Patanga succinta*, first reported from Sungei Ruan, Pahang, in December, 1952, occurred in July, 1953, and was somewhat belatedly reported on the 14th August, thereby depriving the Department of Agriculture of the opportunity possibly to deal effectively with the outbreak before damage resulted. The swarming grasshoppers were found to be present over some 2,500 acres planted with seedling rubber, bananas, dry padi, ginger and vegetables.

Investigations are being carried out by the Senior Entomologist who has prepared and, with the help of the State Agricultural Officer, issued large numbers of pamphlets illustrating and detailing the life history of the pest. The pamphlets also emphasised the necessity of reporting immediately when hoppers appeared, which was predicted for the beginning of October. If this is done it is hoped that they could quickly be destroyed.

General.

The 7th issue, 6,000 copies, of the Kedah Agricultural Newsletter, *Perkhabaran Tanam₂an*—a quarterly publication—was printed and distributed.

Two short broadcast talks on "Mechanisation of Wet Padi" were recorded by State Agricultural Officer, Kedah.

Padi Competitions were held at 15 centres in four different States. The State prize-winning exhibit in each case was retained for entry in the forthcoming Malayan Agri-Horticultural Association Pan-Malayan Show in October.

Review

NEW AND PROMISING VARIETIES RECENTLY DESCRIBED IN THE LITERATURE (8th ISSUE).

*Commonwealth Bureau of Plant Breeding and Genetics, Cambridge,
September, 1953. Pp. 52. Price six shillings.*

Literature on plant breeding frequently refers to the production of some new variety of crop plant possessing special qualities which make it of possible interest not only to growers in the countries concerned but also to plant breeders in other countries, who may be occupied with similar problems. The Commonwealth Bureau, in order to draw the attention of readers to such varieties so that they may, if desired, take steps to procure material or more details of the new variety direct from the producer, publishes from time to time a consolidated report.

The 8th Issue with the above title was published in September, 1953, and, as before, contains a list of the new varieties with their characteristics, origin and source from which a detailed description can be obtained. Mention is also made of the reference in Plant Breeding Abstracts under which reports of the new variety have been made.

This Issue contains brief descriptions of some 1,000 new varieties from 76 genera, including varieties from many different ecological areas, and although the great majority of entries refer to grains, grasses, fruits and vegetables suitable for temperate climates, new varieties of brinjal, tomato, *Aleurites*, sweet potato, groundnuts, and a few others, could have interest for Malaya.

F.B.B.

Departmental Notes

Promotion.

The Right Honourable the Secretary of State for the Colonies has approved the promotion of Mr. L. N. H. Larter, Botanist, to be Senior Botanist with effect from the 14th October, 1952.

Appointments.

The Right Honourable the Secretary of State for the Colonies has approved the following appointments to the Malayan Agricultural Service:—

Mr. D. S. Boyce, Agricultural Engineer, with effect from the 14th July, 1953.

Mr. W. P. Panton, Chemist (Soils), with effect from the 23rd July, 1953.

Mr. I. J. Wyatt, Entomologist, with effect from the 23rd July, 1953.

Mr. G. W. Arnott, Chemist (Soils), with effect from the 23rd July, 1953. Mr. Arnott is at present on study leave in Sweden.

Mr. B. C. Balbernie, Agricultural Officer, with effect from the 23rd July, 1953.

Mr. C. Whitehead, Agricultural Officer, with effect from the 23rd July, 1953.

Mr. L. A. Vivian, Agricultural Officer, with effect from the 23rd July, 1953.

Mr. T. B. Wilson, Agricultural Economist, with effect from the 12th October, 1953.

Dr. G. Youatt, Chemist, with effect from the 5th October, 1953.

The following supernumary appointments under the Colombo Plan have been approved:—

Dr. W. J. Cherewick, Plant Pathologist, with effect from the 9th August, 1953.

Dr. W. F. Grant, Botanist, with effect from the 22nd August, 1953.

Mr. J. R. Curry, Chief Field Officer, ceased to act as Deputy Director of Agriculture with effect from the 13th October, 1953, and as Agricultural Economist with effect from the 16th October, 1953.

Mr. J. Cook, Senior Agricultural Officer, has been appointed State Agricultural Officer, Kelantan, and, in addition, Acting State Agricultural Officer, Trengganu with effect from 22nd October, 1953.

Leave.

Mr. L. N. H. Larter, Senior Botanist, proceeded on leave on the 6th July, 1953.

Mr. H. K. Ashby, Senior Agricultural Officer, proceeded on leave on the 25th October, 1953.

Mr. R. G. Heath, Deputy Director of Agriculture, returned from leave on the 12th October, 1953.

Mr. Gunn Lay Teik, O.B.E., Senior Chemist, returned from leave on the 7th October, 1953.

Resignation.

Mr. E. W. Bewlay, Agricultural Development Officer, resigned his appointment with effect from the 24th September, 1953.

Statistical

MARKET PRICES

July to September, 1953.

Rubber.—The steady decline in the price of this commodity continued during the third quarter, the average Singapore prices for No. 1 R.S.S., f.o.b., in bales, for the three months being: July 65.16; August 64.37; and September 64.11 cents per lb.

July commenced with the price at 65 $\frac{1}{8}$ cents, and after an uncertain start the price rose to 67 cents on the 9th. However, by the 27th July the price had dropped to 63 $\frac{1}{8}$ cents, and on the next day stood at 61 $\frac{7}{8}$, the 1 $\frac{1}{4}$ cent decrease being reported as due to the signing of an armistice in Korea.

The price increased in August, and reached 66 cents per lb. on the 21st; but the increase was not sustained and the price on the last day of the month stood at 63 $\frac{7}{8}$ cents.

In September, the price fluctuated between 64 $\frac{1}{8}$ and 65 $\frac{1}{4}$ cents for the first 20 days but then fell and was 62 $\frac{5}{8}$ cents on the 30th.

The average prices paid for smallholders' rubber at three centres in the Federation of Malaya during the third quarter of 1953 are given in Table I.

Table I.
Average Monthly Prices Paid by Local Dealers for
Smallholders' Rubber, July to September, 1953.

(Dollars per picul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Smoked Sheet	71.97	71.32	70.76	71.80	71.20	71.08	72.76	70.87	70.50
Unsmoked Sheet	61.04	60.23	55.57	51.45	51.59	52.56	61.13	60.73	60.26
Scrap	33.23	32.71	33.22	37.00	33.44	36.08	21.85	23.84	21.15

This Table has been compiled from statistics supplied by the Registrar of Statistics, Federation of Malaya.

Tea.—There were no public sales of Malayan tea in Colombo during the quarter. The average prices of Ceylon teas at the sale held in Colombo

on the 28th September, 1953, as quoted in the Weekly Report of the Colombo Brokers' Association, were, in rupees per lb.:—High Grown Teas 2.10, Medium Grown Teas 1.77, and Low Grown Teas 1.82.

In a return published by the Registrar of Statistics, Federation of Malaya, production of made tea in the Federation during the third quarter of 1953 was given as 49,572 lbs. green and 974,079 lbs. black teas.

Derris.—The price of this commodity, in dollars per picul as quoted in the weekly reports of the Singapore Chamber of Commerce, was 120 in July and 100 in August and September.

Rice.—The ration continued to be $3\frac{1}{2}$ katis* of Government imported and $1\frac{1}{2}$ katis of commercially imported rice per week. The controlled retail prices of rice were fixed on the 17th August as follows, in cents per kati:—High Grade 41, Medium Grade 34, and Low Grade 21.

Table II.
Singapore Prices of Various Agricultural Products.
(Dollars per picul)

Date		Copra, Sundried	Coconut oil*	Pepper, F.A.Q. Muntok white	Pepper, Gen. Muntok white	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1953									
6th	July -	33.00	50.25	470.00	480.00	74.00	13.75	22.75	18.50
13th	July -	32.00	51.00	470.00	480.00	74.00	14.00	22.00	18.50
20th	July -	35.00	53.00	465.00	475.00	74.00	14.50	22.00	18.50
27th	July -	36.00	54.50	425.00	435.00	74.00	14.00	21.50	18.50
4th	Aug. -	34.00	54.50	395.00	405.00	75.00	14.00	21.50	18.50
10th	Aug. -	32.00	54.00	345.00	355.00	75.00	13.75	21.00	18.50
17th	Aug. -	33.25	54.50	350.00	360.00	72.00	14.50	21.00	18.50
24th	Aug. -	32.75	53.00	330.00	340.00	72.00	14.50	20.50	18.50
31st	Aug. -	34.00	54.50	340.00	350.00	71.00	14.75	20.00	18.00
7th	Sept. -	34.50	54.50	345.00	355.00	70.00	14.75	20.00	17.00
14th	Sept. -	35.50	55.50	360.00	370.00	71.00	15.00	19.50	17.00
21st	Sept. -	35.00	55.50	365.00	375.00	70.00	15.00	19.00	17.00
28th	Sept. -	36.00	57.50	370.00	380.00	70.00	14.75	19.00	17.50

* F.O.B.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

FEDERATION OF MALAYA
PRODUCTION OF PALM OIL AND KERNELS.
(In long tons as declared by Estates)

MONTH	PALM OIL		PALM KERNELS	
	1952	1953	1952	1953
January	3,182	3,946	839	1,008
February	3,110	3,611	850	923
March	3,327	3,778	865	1,031
April	3,350	4,061	893	1,066
May	3,076	4,209	793	1,076
June	3,020	4,122	718	1,056
July	3,988	4,500	959	1,150
August	3,819	3,980	931	1,000
September	4,044	4,180	983	1,059
October	4,265		1,066	
November	4,797		1,176	
December	5,117		1,175	
Total	45,095	(36,387)	11,248	(9,369)

In September, 47 estates (planted area 97,778 acres) were in production out of a total of 53 oil palm estates (planted area 101,110 acres).

MALAYAN AGRICULTURAL EXPORTS,
APRIL-JUNE, 1953.

Product	NET EXPORTS IN TONS.			
	Year 1951	Year 1952	Apr. -June, 1952	Apr. -June, 1953
Arecanuts	13,547	10,467	2,807	1,631
Coconuts, fresh † ‡	32,540 †	94,024 †	19,825 †	26,826 †
Coconut oil ‡	68,139	65,113	15,030	12,804
Copra ‡	10,878 *	27,821 *	11,147 *	2,022
Copra cake	37,891 *	60,287 *	18,978 *	12,224 *
Gambier, all kinds	36	94 *	20 *	6
Palm Kernels	11,809	10,869	2,440	3,125
Palm Oil	45,022	46,008	10,284	11,755
Pineapples, canned	16,859	11,762	2,960	4,169
Rubber ¶	603,880 ¶	582,646 ¶	137,882 ¶	132,685 ¶
Sago,—flour	28,044	19,146	6,082	8,601
" —pearl	3,401	5,553	1,249	1,453
" —raw	27,603 *	24,835 *	4,920 *	5,861 *
Tapioca,—flake	462	39 *	7	57 *
" —flour	4,475 *	4,075 *	1,380 *	2,422 *
" —pearl	10,230	6,304	1,680	1,039
Derris	56	13 *	2	—
‡ Copra equivalent	100,499	79,868	13,673	23,365

¶ production (Federation of Malaya).

† hundreds in number.

* net imports.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

MONTH	ESTATES		SMALLHOLDINGS (ESTIMATED)		TOTAL	
	1952	1953	1952	1953	1952	1953
January	27,044	31,354	23,770	23,514	50,814	54,868
February	24,007	23,423	19,200	19,140	43,207	42,563
March	25,679	26,898	20,810	16,882	46,489	43,780
April	25,533	26,155	19,065	16,805	44,598	42,960
May	27,362	27,820	18,346	17,679	45,708	45,499
June	27,243	27,202	20,333	17,024	47,576	44,226
July	29,473	30,188	20,299	20,400	49,772	50,588
August	28,301	29,511	22,052	21,491	50,353	51,002
September	28,690	28,934	20,005	18,394	48,695	47,328
October	29,369		18,856		48,225	
November	31,827		18,855		50,682	
December	33,800		22,727		56,527	
Total	338,921 *	(251,485)	244,318	(171,329)	583,239 *	(422,814)
Total 1951	327,956		275,924		603,880	

This Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

Smallholding production is estimated from purchases reported by dealers.

These figures include an adjustment of 593 tons. The monthly production figures have not been altered.

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1952-1953.

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State or Settlement (1)	TOTAL WET AND DRY PADI								Production		
	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Yield of Padi (5) Gantangs (’000s)	per cent of total	Rice Production (6) tons		
	Acres	per cent of total	Acres	per cent of (2)	Acres	per cent of (2)					
Perlis	...	...	48,770	5.9	610	1.3	48,160	98.7	21,630	7.8	34,060
Kedah	...	...	183,030	33.8	3,620	1.3	276,410	98.7	120,766	43.3	190,190
Kelantan	...	...	174,100	21.0	500	.3	173,600	99.7	45,542	16.3	71,710
Trengganu	...	...	54,810	6.6	500	.9	54,310	99.1	13,182	4.7	20,760
Penang & Province Wellesley	...	...	38,530	4.6	—	—	38,530	100.0	10,556	3.8	16,620
Perak	...	...	100,770	12.2	360	.4	100,410	99.6	27,510	9.9	43,330
Selangor	...	...	45,690	5.5	1,340	2.9	44,350	97.1	16,072	5.8	25,310
Pahang	...	...	30,140	3.6	470	1.6	29,670	98.4	6,532	2.3	10,290
Negri Sembilan	...	...	28,570	3.4	140	.5	28,430	99.5	8,951	3.2	14,100
Malacca	...	...	26,650	3.2	1,410	5.3	25,240	94.7	7,867	2.8	12,390
Johore	...	...	1,290	.2	20	1.6	1,270	98.4	279	.1	440
TOTAL	...	...	829,350	—	8,970	1.1	820,380	98.9	278,887	—	439,200
Off-Season Crop	...	...	4,660	—	230	4.9	4,430	95.1	1,146	—	1,800
Total, 1952-1953	...	...	834,010	—	9,200	1.1	824,810	98.9	280,033	—	441,000
Total, 1951-1952	...	...	831,050	—	31,630	3.8	799,420	96.2	216,552	—	341,020

Acreages to nearest 10 acres.
 Rice production to nearest 10 tons.
 Conversion Rate: 635 gantangs padi = 1 ton rice (i.e., milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1952-1953.

Wet Padi

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield Per Acre			Production			Remarks (9)	
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	Padi (5)	per cent. of average for season	Rice (6)	Yield of padi (7)		per cent. of total		Rice Production (8) tons
										gan-tangs	lbs.			
Perlis	48,690	6.2	610	1.3	48,080	98.7	450	128.2	1,584	21,618	7.9	34,040	360 acres damaged by pests and diseases.	
Kedah	277,330	35.3	3,610	1.3	273,720	98.7	440	125.4	1,549	120,407	44.2	189,620	250 acres damaged by drought. 3,450 acres damaged by drought. 160 acres damaged by pests and diseases.	
Kelantan	145,100	18.5	490	.3	144,610	99.7	285	81.2	1,003	41,170	15.1	64,830	190 acres not harvested due to late planting and attack by pests and diseases. 500 acres damaged by rats.	
Trengganu	46,280	5.9	500	1.1	45,780	98.9	260	74.1	915	11,914	4.4	18,760		
Penang and P. Wellesley	38,510	4.9	—	—	38,510	100.0	274	78.1	964	10,555	3.9	16,620		
Perak	99,730	12.7	360	.4	99,370	99.6	276	78.6	972	27,386	10.0	43,130	360 acres failed due to lack of water.	
Selangor	43,690	5.8	1,340	2.9	44,350	97.1	362	103.1	1,274	16,072	5.9	25,310	1,340 acres failed due to lack of water and late planting.	
Pahang	27,780	3.5	400	1.4	27,380	98.6	226	64.4	796	6,176	2.3	9,730	400 acres failed due to lack of water.	
N. Sembilan	28,560	3.6	140	.5	28,420	99.5	315	89.7	1,109	8,950	3.3	14,100	140 acres failed to yield due to late planting.	
Malacca	26,650	3.4	1,410	5.3	25,240	94.7	312	88.9	1,098	7,866	2.9	12,390	410 acres damaged by pests. 800 acres failed to yield due to late planting.	
Johore	1,290	.2	20	1.6	1,270	98.4	220	62.7	774	279	.1	440	200 acres failed due to drought. 20 acres destroyed by birds.	
TOTAL	785,610	—	8,880	1.1	776,730	98.9	351	—	1,236	272,393	—	428,970		
Off-Season Crop	4,230	—	10	.2	4,220	99.8	266	—	936	1,125	—	1,770		
Total, 1952-53	789,840	—	8,890	1.1	780,950	98.9	350	—	1,232	273,518	—	430,740		
Total, 1951-52	790,110	—	31,500	4.0	758,610	96.0	277	—	975	210,285	—	331,150		

Acreages to nearest 10 acres. Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs padi = 1 ton rice (i.e., milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1952-1953.

Dry Padi

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State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield Per Acre			Production			Remarks (9)
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	Padi (5)	per cent. of average for season	Rice (6)	Yield of padi (7) gan- tangs ('000s)	per cent. of total	Rice Pro- duction (8) tons	
Perlis	80	.2	—	—	80	100.0	153	106.0	556	12	.2	20	
Kedah	2,700	6.2	10	.4	2,690	99.6	134	90.0	472	359	5.5	570	10 acres destroyed by pests.
Kelantan	29,000	66.3	10	.1	28,990	99.9	151	101.3	531	4,372	67.4	6,880	10 acres not harvested due to late planting.
Trengganu	8,530	19.5	—	—	8,530	100.0	149	100.0	524	1,268	19.5	2,000	
Penang and P. Wellesley	20	—	—	—	20	100.0	60	40.3	211	1	—	—	
Perak	1,040	2.4	—	—	1,040	100.0	120	80.5	422	124	1.9	200	
Selangor	—	—	—	—	—	—	—	—	—	—	—	—	
Pahang	2,360	5.4	70	3.0	2,290	97.0	156	104.7	549	356	5.5	560	70 acres destroyed by pests.
N. Sembilan	10	—	—	—	10	100.0	120	80.5	422	1	—	—	
Malacca	—	—	—	—	—	—	224	150.3	788	1	—	—	Only 5 acres planted.
Johore	—	—	—	—	—	—	—	—	—	—	—	—	3 acres planted but destroyed by birds.
TOTAL	43,740	—	90	.2	43,650	99.8	149	—	524	6,494	—	10,230	
Off-Season Crop	430	—	220	51.2	210	48.8	100	—	352	21	—	30	
Total, 1952-53	44,170	—	310	.7	43,860	99.3	149	—	524	6,515	—	10,260	
Total, 1951-52	40,940	—	130	.3	40,810	99.7	154	—	542	6,267	—	9,870	

Acreages to nearest 10 acres. Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs padi = 1 ton rice (i.e., milling recovery = 63 per cent.)

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	COPRA PRODUCTION				COCONUT OIL PRODUCTION		COPRA CAKE (POONAC) MANUFACTURED	
	Estates		Smallholdings (estimated)		Total		Oil Mills	
	1952	1953	1952	1953	1952	1953	1952	1953
January	2,740	2,555	9,296	8,241	12,036	10,796	6,681	5,597
February	2,777	2,405	8,510	6,092	11,287	8,497	6,338	4,236
March	2,864	2,793	8,522	6,703	11,386	9,496	5,616	4,800
April	2,964	2,753	8,684	7,972	11,648	10,725	6,128	5,294
May	3,279	3,306	8,560	8,744	11,839	12,050	5,797	5,666
June	3,643	3,357	7,642	9,842	11,285	13,199	6,067	6,478
July	3,846	4,196	11,294	9,718	15,140	13,914	7,177	6,699
August	4,151	4,070	10,357	11,179	14,508	15,249	7,645	7,935
September	3,848	4,103	12,426	10,332	16,274	14,435	8,292	7,782
October	3,358		10,757		14,115		7,622	5,014
November	3,103		9,569		12,672		7,214	4,981
December	2,950		9,225		12,175		6,608	4,695
Total	39,523	(29,538)	114,842	(78,823)	154,365	(108,361)	81,185	(54,487)
							51,581	(34,748)

Notes:—1. The above Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1953.

LOCALITY	AIR TEMPERATURE DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE	
	Means of		Absolute Extremes		At 1 foot °F	At 4 feet °F	Total	Most in a day	Number of days				Per cent.
									Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	For morning obs.	
	A. Max.	B. Min.	Highest Max.	Lowest Min.			ins. m m.						
Ipoh, Perak	93.5	73.0	97.2	70.4	85.5	75.7	3.68	93.5	ins.	9			hrs. 240.87
Port Swettenham, Selangor	89.6	72.6	91.1	72.3	85.8	74.3	4.08	105.6	1.23	13			hrs. 210.85
Kuala Lumpur, Selangor	91.5	73.3	92.4	71.1	85.8	75.4	3.68	93.5	0.85	13			6.80
Sitiawan, Perak	90.7	73.3	92.0	70.8	87.5	75.6	3.41	86.6	1.14	13	6		
Kuala Lipis, Pahang	90.3	71.7	91.0	69.0	83.0	74.0	3.32	84.3	1.20	9	7	2	hrs. 242.55
Kuantan, Pahang	90.7	72.3	91.5	68.8	83.5	76.8	2.98	75.7	1.27	8	9	29	hrs. 216.40
Temerloh, Pahang	90.3	73.1	91.7	69.6	80.4	71.0	1.38	35.1	1.10	9	7	3	hrs. 216.30
Bayan Lepas, Penang	88.1	74.7	81.4	71.5	80.8	76.6	14.65	372.1	0.45	7	5	13	hrs. 225.65
Malacca	86.1	74.3	80.2	68.7	81.7	78.3	6.09	175.3	7.02	11	10	3	hrs. 214.30
Mersing, Johore	88.1	72.5	80.3	69.2	85.0	75.8	3.26	82.8	2.93	14	13	5	hrs. 237.60
Alor Star, Kedah	88.6	74.7	91.7	71.7	76.5	78.3	6.79	172.5	0.77	13	10	6	hrs. 241.50
Kota Bharu, Kelantan	89.7	74.1	91.9	72.2	87.1	76.4	2.05	52.1	1.91	13	12	1	hrs. 204.20
K. Trengganu, Trengganu	89.2	72.7	90.9	70.2	87.0	77.5	4.06	103.1	0.51	11	7	2	hrs. 237.20
Singapore	88.4	77.5	92.9	71.0	85.2	80.7	4.93	125.2	1.26	14	13	7	hrs. 243.70
HILL STATIONS.									1.42	10	9		hrs. 225.25
Fraser's Hill,													
Pahang 4268 ft.	74.0	62.5	68.3	59.0	68.3	64.7	2.24	56.9	0.97	9	9	2	hrs. 189.50
Cameron Highlands, Tanah													
Rata, Pahang 4750 ft.	73.3	56.1	64.7	50.0	69.0	52.0	3.52	89.4	0.90	11		3	hrs. 6.11

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1953.

LOCALITY	AIR TEMPERATURE DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE			
	Means of			Absolute Extremes		At 1 foot °F	At 4 feet °F	Total ins. m.m.	Number of days					Total hr.	Daily Mean	
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.				Lowest Max.	Highest Min.	Precipitation 0.1 in or more	Precipitation 0.4 in or more	Thunderstorm obs. morning			Gale force 8 or more
Ipoh, Perak	90.4	72.7	81.5	93.0	70.4	85.0	76.8	8.90	226.1	1.87	20	16	2	1	169.60	5.65
Port Swettenham, Selangor	88.5	72.5	80.5	92.0	70.1	83.6	75.3	3.54	89.9	1.20	19	14			171.10	5.70
Kuala Lumpur, Selangor	89.8	72.9	81.3	92.3	70.4	85.3	76.2	9.36	237.7	2.06	21	19	5	2		
Sitiawan, Perak	88.4	73.2	80.8	90.5	71.2	86.2	76.0	3.72	94.5	0.82	16	14	2	2	169.00	5.63
Kuala Lipis, Pahang	88.9	71.5	80.2	92.6	69.0	85.8	75.0	10.91	277.1	1.43	20	19	2	28	162.65	5.42
Kuantan, Pahang	89.3	71.9	80.6	92.7	68.9	84.9	75.6	13.54	343.9	2.64	19	17	6		194.30	6.48
Temerloh, Pahang	90.0	73.0	81.5	93.5	70.7	85.5	76.0	3.80	96.5	0.60	19	13	7	11	175.90	5.86
Bayan Lepas, Penang	86.1	74.2	80.1	89.2	73.0	80.0	76.1	17.04	432.8	2.37	24	21	2	2	135.40	4.51
Malacca	85.2	74.4	79.8	87.2	72.3	79.1	77.2	8.18	207.8	1.76	18	16	4		192.15	6.41
Mersing, Johore	87.5	71.5	79.5	90.7	69.1	81.6	74.5	6.38	162.1	1.32	16	13	6	1	188.05	6.27
Alor Star, Kedah	85.7	73.9	79.8	88.9	71.8	78.0	76.1	13.38	339.9	2.38	19	17			134.25	4.47
Kota Bharu, Kelantan	88.2	73.7	80.9	90.9	72.0	83.4	75.2	7.88	200.2	2.38	15	12	1		177.10	5.90
K. Trengganu, Trengganu	87.7	72.4	80.1	89.2	69.8	85.2	75.9	10.11	256.8	3.79	16	15	6		187.00	6.23
Singapore	87.3	76.1	81.7	89.8	71.8	83.2	81.2	4.87	123.7	1.40	10	8	5		143.80	4.79
HILL STATIONS.																
Fraser's Hill,	73.4	61.7	67.5	76.6	60.0	70.0	64.7	9.44	239.8	2.00	20	15			164.15	5.47
Pahang 4268 ft.							72.0									
Cameron Highlands, Tanah																
Rata, Pahang 4750 ft. ...	71.8	57.5	64.7	77.0	53.0	66.0	63.0	12.41	315.2	2.46	22				121.60	4.05

Compiled from Returns supplied by the Malayan Meteorological Service.